SUPPLEMENT

TO THE

DRAFT FISH AND WILDLIFE COORDINATION ACT REPORT

FOR THE

MODIFIED WATER DELIVERIES TO

EVERGLADES NATIONAL PARK, FLORIDA

THE 8.5 SQUARE MILE AREA

GENERAL REEVALUATION REPORT AND

SUPPLEMENTAL ENVIRONMENTAL IMPACT STATEMENT

FOR ALTERNATIVE 6C

Prepared by:

U.S. Fish and Wildlife Service
South Florida Field Office
Vero Beach, Florida

and

National Park Service
Everglades National Park
Homestead, Florida

March 23, 2000

Revised March 30, 2000

Supplement Submitted April 26, 2000

United States Department of the Interior

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April 25, 2000

Colonel Joe R. Miller
District Commander, Jacksonville District
U.S. Army Corps of Engineers
P.O. Box 4970
Jacksonville, Florida 32232-0019

Attention: Planning Division

RE: Supplement to the Draft Fish and Wildlife Coordination Act Report for the 8.5 Square Mile Area

Dear Colonel Miller:

The Department of the Interior (Department) has prepared the enclosed Supplement to the Draft Fish and Wildlife Coordination Act (FWCA) Report for the Corps of Engineers' (Corps) Draft Supplemental Environmental Impact Statement/General Reevaluation Report (SEIS/GRR) for the Modified Water Deliveries (MWD) to Everglades National Park, 8.5 Square Mile Area (SMA), Miami-Dade County, Florida. This document supplements the Draft FWCA report submitted to the Corps on March 31, 2000, by the National Park Service (NPS) and the Fish and Wildlife Service (Service), and we request that it be appended to the publicly released draft SEIS/GRR. This supplement addresses the evaluation of Alternative 6C, a new plan proposed for inclusion into the SEIS for this project on April 14, 2000, following a request by the South Florida Water Management District on April 12, 2000.

The Final FWCA report, including the views and recommendations of the Florida Fish and Wildlife Conservation Commission (FWCC), will be submitted for inclusion in the Final SEIS/GRR, and will fulfill the requirements of section 2(b) of the FWCA (48 Stat. 401, as amended; 16 U.S.C. 661 *et seq.*), representing the Secretary of the Interior's report to Congress. The Department will also submit formal comments on the Draft SEIS/GRR that may address additional issues not analyzed in this report.

Pending the selection of a federally preferred alternative and receipt of the Corps' effect determination on federally listed species, the Service anticipates coordination with the Corps pursuant to the consultation requirements of section 7 of the Endangered Species Act (ESA) of 1973, as amended (16 U.S.C. 1531 *et seq*).

We look forward to joining the Corps in reviewing our analysis and recommendations with the Governing Board of the South Florida Water Management District in the near future. Additionally, we appreciate the Corps' concerted efforts to prepare a Draft SEIS/GRR for the 8.5 SMA project under such limited time constraints.

Sincerely yours,

FOR Richard G. Ring
Superintendent
Everglades National Park
& Dry Tortugas National Park

Stephen W. Forsythe
Florida State Supervisor
Ecological Services
U.S. Fish and Wildlife Service

Enclosure

cc:
Executive Director, SFWMD, West Palm Beach, FL
Executive Director, FWCC, Tallahassee, FL
Environmental Services, FWCC, Vero Beach, FL
Miccosukee Tribe of Florida, Miami, FL
Seminole Tribe of Florida, Hollywood, FL
Service, So. Fla. Ecological Services Office, Vero Beach, FL

The Fish and Wildlife Service (Service) and the Everglades National Park (ENP), as cooperating agencies, have jointly prepared this Supplement to the Draft Fish and Wildlife Coordination Act Report (SDCAR) submitted to the Jacksonville District U.S. Army Corps of Engineers (Corps) on March 30, 2000 for incorporation into the Draft General Reevaluation Report and Supplemental Environmental Impact Statement (GRR/SEIS). This SDCAR is to be attached to and accompany the Draft Fish and Wildlife Coordination Act Report (DCAR) as The Department of Interior's (DOI) analysis and position pertaining to the alternatives proposed for implementation of the 8.5 Square Mile Area (8.5 SMA) component of the Modified Water Deliveries to Everglades National Park (MWD) Project. The 8.5 SMA project is authorized by the Everglades National Park Protection and Expansion Act (P.L. 101-229), December 13, 1989 and the 1992 General Design Memorandum (GDM) for the MWD.

Preparation of this SDCAR was approved by a signed Scope of Work, cooperatively prepared by the Corps and the Service, in accordance with the Transfer Funding Agreement between the Corps and the Service in order to address the evaluation of Alternative (6C) designed to mitigate flooding within the 8.5 SMA from the implementation of MWD. This alternative was presented to the Corps by the South Florida Water Management District on April 14, 2000. This SDCAR is consistent with the format of the DCAR, with the exception of any reference to the Executive Summary, as well as Chapters 1, 2, and 3. This report contains a description of the alternative (Supplement to Chapter 4), hydrologic impact evaluation (Supplement to Chapter 5), wetland functional evaluation (Supplement to Chapter 6), evaluation of effects on federally listed threatened and endangered species (Supplement to Chapter 7), a preliminary evaluation of alternative performance (Supplement to Chapter 8), a preliminary review of supplemental benefits of the alternatives and DOI recommendations (Supplement to Chapter 9), and a preliminary summary of DOI's position regarding the alternative (Supplement to Chapter 10).

This Draft Fish and Wildlife Coordination Act Report (CAR) has been prepared by the Fish and Wildlife Service and Everglades National Park (ENP) as cooperating agencies for the Supplement to the U.S. Army Corps of Engineers' (Corps) 1992 General Design Memorandum and Final Environmental Impact Statement, Modified Water Deliveries to Everglades National Park (MWD Project.) The purpose of the MWD Project is to improve delivery of water into ENP and, to the extent practicable, restore hydropatterns in Northeast Shark River Slough (NESRS). This CAR summarizes analyses of the proposed alternatives for mitigation of higher water levels in the 8.5 square mile area (8.5 SMA) resulting from the restoration of NESRS through the MWD Project.

The 8.5 SMA is located within the eastern periphery of the historic Everglades flow path. Within the 8.5 SMA land use is dominated by agriculture, but also includes residences, and wetlands. The land cover within ENP consists of long and short hydroperiod wetlands interspersed with tree islands, which combine to support a diverse assemblage of vegetation and wildlife.

The nine proposed alternatives include both structural water conveyance systems and landowner compensation arrangements and are listed in Table ES–1. The six objectives of the 8.5 SMA component of the MWD Project used by DOI to evaluate the nine proposed alternatives were divided into objectives authorized in law and other objectives (those desirable to the interested parties).

Legislative Requirements:

- Evaluate effects on hydropatterns in NESRS according to Section 104 of the 1989 Everglades National Park Protection and Expansion Act

- Evaluate impacts to the landowners and residents of the 8.5 SMA resulting from implementation of the MWD Project according to Section 104 of the 1989 Everglades National Park Protection and Expansion Act

- Evaluate effects on Federal and State Listed Endangered Species survival in accordance with the Endangered Species Act of 1973

Other Objectives:

- Analyze effects to ecological function

- Measure compatibility with Comprehensive Everglades Restoration Plan (CERP) and C-111 Project without adversely impacting the current level of flood protection east of L-31N

- Analyze impacts and costs associated with time delays in implementation of alternatives

For each of the alternatives requiring structural changes, a hydrologic model (MODBRANCH) was used to predict the resulting water levels for both a wet and a dry year. Analysis of these water levels combined with the Wetland Rapid Assessment Procedure provided the data required to evaluate the alternatives with regard to the stated objectives.

Table ES–1 Summary 8.5 SMA Alternative Evaluation

	Legislative Requirements				Other Objectives			
Alternative	NESS Restoration (acre-ft reduction in restored water in NESRS)	Structural Mitigation Provided (acres mitigated)	Non-structural mitigation required (acres)	Endangered Species Protection (rank[1]) sk: snail kite ws: wood stork[2])	Wetland Function (Increase in functional units)	Compatibility with future restoration	Time to Implementation	Flood Protection (acres protected)
1 — GDM plan (No action)	Poor (6,979)	6,646	263	Sk: 3 Ws: 2	Poor (-2,765)	Poor	< 3 years	Not provided (586)[3]
2B — Modified GDM	Poor (9,912)	6,909	0	Sk: 1 Ws: 4	Poor (-2,765)	Poor	< 3 years	Not provided (704)[3]
3 — Deep Seepage Barrier	Good (0)	2,652	4,257	Sk: 10 Ws: 1	Poor (-1,775)	Poor	< 3 years	Poor (586)
4 — Residents' Choice Land Acquisition	Good (0)	0	6,909	Sk: 9 Ws: 10	Best (2,448)	Good	< 3 years	Good (6,909)[3]
5 — Total Buyout	Best (0)	0	6,909	Sk: 9 Ws: 10	Best (2,448)	Best	< 3 years	Good (6,909)[3]
6B — Buffer Plan	Good (868)	1,992	4,917	Sk: 5 Ws: 8	Good (1,606)	Fair	< 3 years	Good (1,452)
6C — Modified Buffer Plan	Poor (6,711)	5,251	1,658	Sk: 4 Ws: 5	Poor (1,805)	Poor	< 3 years	Poor (1,799)
7 — Raise all public roads	Good (0)	0	6,909	Sk: 9 Ws: 6	Good (1,290)	Good	< 3 years	Not provided (586)[3]
8A — Western Flow-way	Good (117)	2,975	3,934	Sk: 6 Ws: 7	Good (2,240)	Good	< 3 years	Not provided (737)[3]
9 — Adaptive Refinement of GDM	Poor (9,912)	6,909	0	Sk: 1 Ws: 4	Poor (-2,765)	Poor	< 3 years	Not provided (704)[3]

[1]Rank from 1 (Lowest) to 10 (Highest)

[2]Other species to be evaluated include Cape Sable seaside sparrow, Eastern indigo snake and Florida panther

[3]For Alternatives not designated as flood protection alternatives, acreage represents area provided incidental 1 in 10 year flood protection

The DOI screened the alternatives by requiring that they satisfy all three of the legislative requirements. To receive the highest rating, alternatives were required to: 1) provide at least 95 percent of the predicted potential increase in water storage in NESRS from implementation of the MWD Project, 2) mitigate for adverse hydrologic impacts to the presently developed portions of the 8.5 SMA resulting from implementation of the MWD Project, and 3) provide conditions favorable to Federal and State Listed Endangered Species survival. Alternatives 4, 5, and 6B satisfy these criteria.

It is the opinion of DOI that Alternative 5 is the best alternative (Figure ES–1) because it provides the greatest increase in wetland function, allows for complete restoration of NESRS consistent with the objectives of the MWD Project, and provides full flood mitigation and flood protection. Alternative 4 is less compatible with future restoration, such as the CERP, because continued residential use could constrain future restoration and wetland function is only moderately increased. Alternative 6B was evaluated as fair because it provides only moderate increases in wetland function in NESRS and could require retrofitting for future restoration project features. Alternative 8 meets the restoration criteria but does not meet the full flood mitigation criteria. It is the opinion of DOI that the remaining alternatives do not meet multiple legislative requirements, as well as the other project objectives.

For alternatives 4, 5, and 6B, significant supplemental benefits in excess of the no-action alternative are accrued by the ecosystem in general and by ENP in particular. In recognition of these supplemental benefits, the Secretary of the Interior may decide to provide additional support in the implementation of the alternative selected.

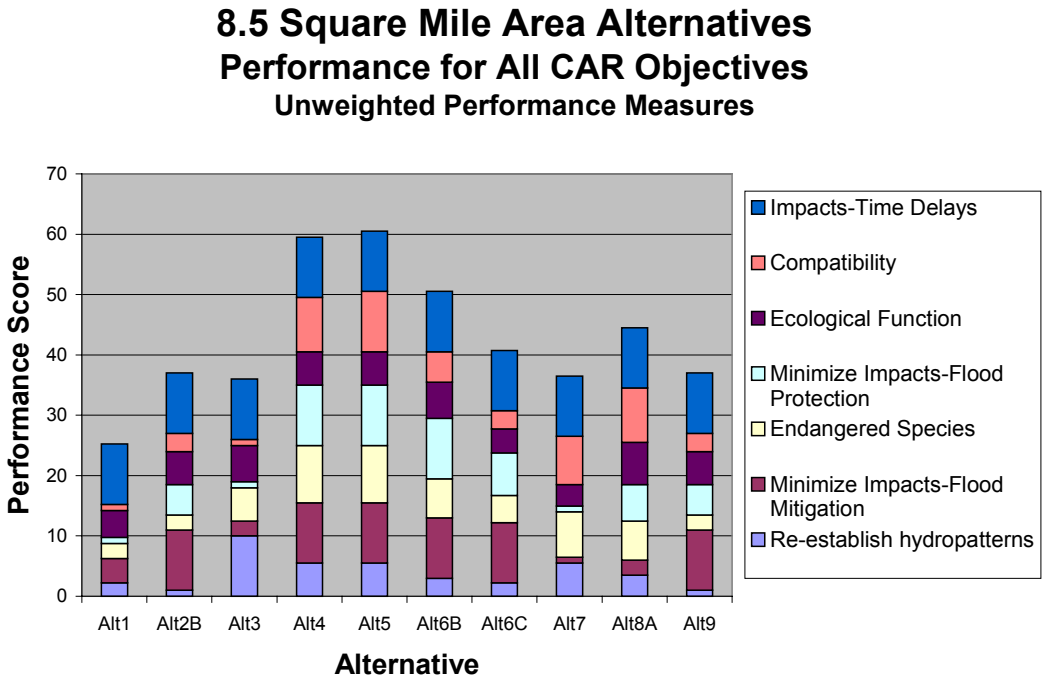


Figure ES–1 8.5 SMA Performance Scores for Objectives Analyzed in the CAR (unweighted)

Supplement Appendices

Supplement to Appendix D Hydrologic Modeling Results

Supplement to Appendix D Wood Stork Analysis Results for Alternative 6C

Supplement to Chapter 4 — Project Alternatives

Selected Plan/Project

At this stage in the planning process, there has yet to be identified a federally preferred alternative for the 8.5 SMA SEIS.

Other Alternatives

A total of nine alternatives were evaluated. Some of the alternatives were modified from their original conceptual deign in order to investigate performance of minor refinements to the original design. Examples of the types of modifications made by the Corps include changes to pump station capacity and depth of the seepage collector canal. These design modifications resulted in the multiple variations for a given alternative. These alternatives were designated with an alpha suffix after the alternative such as 2A or 6B. A complete explanation of each variation of an alternative is provided in Appendix A of the Draft SEIS. All alternatives with the exception of Alternative 6C were also briefly described in the March 30, 2000 version of the Coordination Act report. Therefore, only Alternative 6C is described below.

Alternative 6C — Save Our Rivers Alignment as Eastern boundary of Buffer Area

Under this alternative, the western portion of the 8.5 SMA would be converted to a shallow impoundment to be used as a buffer between the developed area and ENP. The eastern part of the 8.5 SMA would be provided flood protection through the construction of a flood protection levee and drainage system. A major perimeter levee would be constructed along 202nd Avenue down to 168th Street. A seepage canal, which would be designed to collect ground water underflow, would be located just east of the major levee. A minor levee would be constructed east of the seepage canal to prevent surface water from running into the seepage canal and mixing with seepage water.

A single pumping structure (S–357) would be constructed at the southern terminus of the levee/canal system. This station would convey seepage water into a spreader canal running west along the south side of 168th Street. The spreader canal would release the water south into the C–111 Project. No major changes to the operation of existing structures or sytem would occur.

Supplement to Chapter 5 — Hydrologic Impact Evaluation

The purpose of this analysis was to evaluate hydrologic model outputs for Alternative 6C to determine to what extent each meets the following objectives:

Legislative Requirements:

1. Evaluate effects on hydropatterns in NESRS according to Section 104 of the 1989 Everglades National Park Protection and Expansion Act of 1989.

2. Evaluate impacts to the landowners and residents of the 8.5 SMA resulting from implementation of the MWD project according to Section 104 of the 1989 Everglades National Park Protection and Expansion Act of 1989.

3. Evaluate effects on Federal and State Listed Endangered Species survival in accordance with the Endangered Species Act of 1973. (This objective is primarily addressed in Chapter 7)

Other Objectives:

4. Analyze effects to ecological functions (This objective is primarily addressed in Chapter 6).

5. Measure compatibility with the Comprehensive Everglades Restoration Plan and C–111 Project without adversely impacting the current level of flood protection east of L-31N.

For a detailed explanation of the methodology used in the hydrologic analysis, the reader is referred to the March 30, 2000 version of the Coordination Act Report.

Northeast Shark River Slough Hydropattern Restoration

To re-establish historical hydropatterns in NESRS, it is necessary to increase hydroperiod and water depth to restore the peat-forming environment that was historically maintained. Comparing Figure 13 of the Draft CAR and Figure S.5.1, the difference in hydroperiods for MWD Project restoration and plan 6C reveals how placement of a canal and levee around the 8.5 SMA would have a detrimental effect on hydroperiods in NESRS.

Table S.5.1 Spatial Increases and Decreases in Hydroperiod and Average Water Depth in NESRS Relative to Restored Hydroperiod and Water Depth for Wet Year (1995)

	Hydroperiod		Depth	
Plan	Increased (acres)	Decreased (acres)	Increased (acres)	Decreased (acres)
Plan 1	0	3,158	0	27,173
Plan 1A	0	3,338	0	27,321
Plan 2	82	1,144	1,243	6,288
Plan 2A	0	3,147	0	31,429
Plan 2B	0	3,275	0	36,640
Plan 3	82	0	14,934	0
Plan 4	0	0	0	0
Plan 5	0	0	0	0
Plan 6	39	67	537	699
Plan 6A	39	67	0	3,447
Plan 6B	0	294	0	6,035
Plan 6C	0	1996	0	27,446
Plan 7	0	0	0	0
Plan 8	0	67	0	0
Plan 8A	0	286	0	705
Plan 9B	0	3,275	0	36,640

Hydroperiods in NESRS would be reduced in almost 2,000 acres of ENP under plan 6C (see Table S.5.1). By placing the canal and levee alignment in the middle of the marl prairie, 75% of the marl forming wetlands are drained. In fact, Plan 6C is designed with the exterior levee extending into ENP which violates the 1989 Everglades Expansion and Protection Act. Another critical measure of NESRS wetland restoration is water depth (Table S.5.). Changes in water depth during the wet year for the various alternatives range from 0.1 feet to more than 1 foot over areas ranging from a few hundred acres to thousands of acres. Under Plan 6C, water depth is reduced in over 27,000 acres in NESRS wetlands.

The difference in average water volume decreases (acre-ft) between restoration and each plan is an estimate of the volume of restored water lost as a result of the plan. This difference is determined by multiplying the cell area by the change in average water depth. These values are reported in Table S.5.2. Plan 6C causes a loss of 32% of the restored water, decreasing storage by 6,700 acre-ft.

Table S.5.2 Increases And Decreases In Water Volume In NESRS Relative To Restored Conditions for Wet Year (1995)

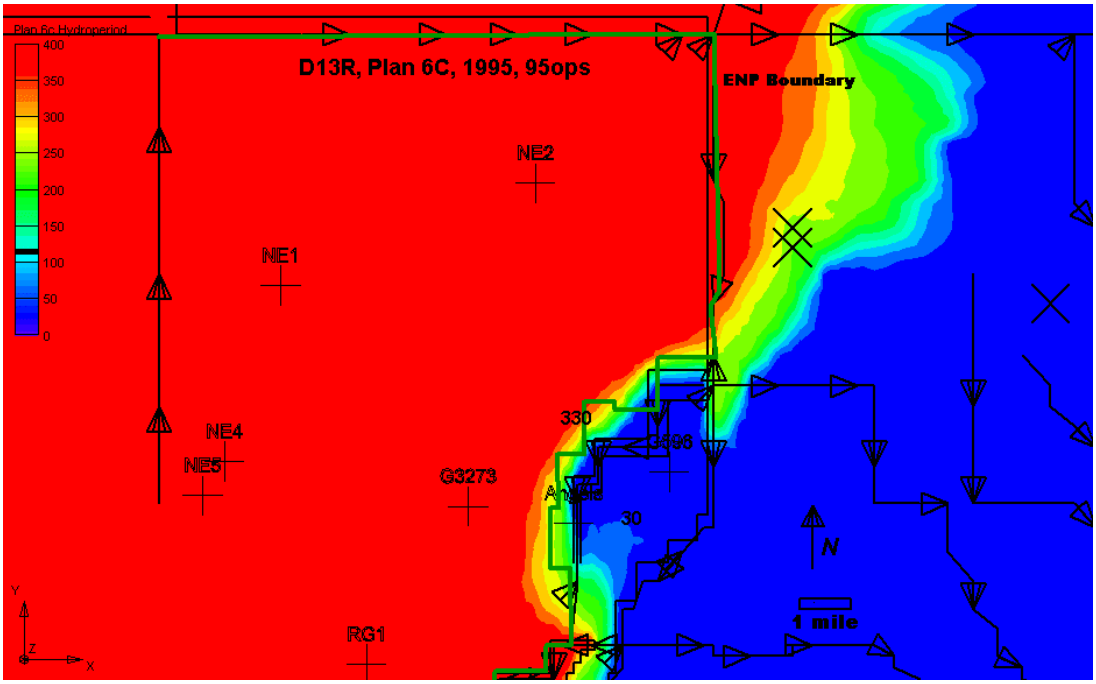
	Water Volume		
Plan	Increase (acre feet)	Decrease (acre feet)	Portion of restored water lost (percent)
C–111	0	21,042	0
Plan 1	0	6,979	33.2
Plan 1A	0	7,032	33.4
Plan 2	232	1,061	5.0
Plan 2A	0	7,808	37.1
Plan 2B	0	9,912	47.1
Plan 3	2,626	0	0
Plan 4	0	0	0
Plan 5	0	0	0
Plan 6	74	88.5	0.4
Plan 6A	0	455	2.2
Plan 6B	0	868	4.1
Plan 6C	0	6711	31.9
Plan 7	0	0	0
Plan 8	0	0	0
Plan 8A	0	117	0.6
Plan 9	0	9,912	47.1

Table S.5.3 Mitigation: Spatial Extent of Inundation and Average Water Depth In 8.5 SMA Relative To Existing Conditions for Wet Year (1995)

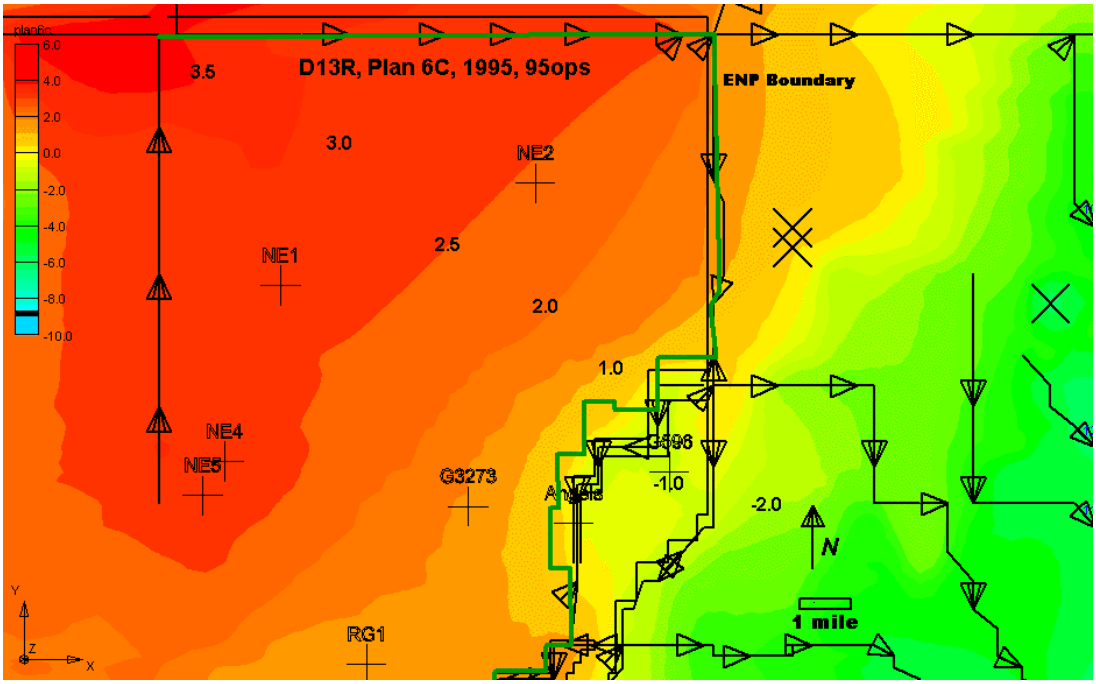
	Hydroperiod		Depth		Area Not
	Increased	Decreased	Increased	Decreased	Mitigated
Plan	(acres)	(acres)	(acres)	(acres)	(acres)
Plan 1	263	5,897	102	4,400	263
Plan 1A	263	5,951	102	4,400	263
Plan 2	5,260	708	2,679	0	5,260
Plan 2A	115	5,951	0	4,744	115
Plan 2B	0	6,155	0	5,251	0
Plan 3	4,257	1,585	3,669	0	4,257
Plan 4	6,135[a]	0	5,402[a]	0	0[a]
Plan 5	6,135[a]	0	5,402[a]	0	0[a]
Plan 6	0	765	0	1,214	0
Plan 6A	0	805	0	1,318	0
Plan 6B	0	805	0	1,603	0
Plan 6C	0	4059	0	4203	0
Plan 7	6,135	0	5,402	0	6,135
Plan 8	5,976	188	4,986	0	5,976
Plan 8A	3,934	1,944	3,796	840	3,934
Plan 9B	0	6,155	0	5,251	0

Note:

a. For plans 4 and 5, flood mitigation is achieved through life estates or acquisition.



A) Hydroperiods (360 days in NESRS to 0 days in the 8.5 SMA)



B) Average Depths (3.5 feet in NESRS to 1 foot below ground surface in the southeastern part of the 8.5 SMA)

Figure S.5.1 Hydroperiods and Average Depths for Existing Conditions with C-111 Project Implementation

Flood Mitigation and Flood Protection

Flood mitigation was evaluated in terms of both increases in hydroperiod and average depth. The results are presented in Table S.5.3. The entire designated flood protection area east of the mitigation canal is provided mitigation under plan 6C.

Flood protection in the 8.5 SMA was evaluated for all of the plans, although only plans 3 and 6 were proposed as flood protection alternatives. Parcels were considered to receive flood protection if the water surface was below the ground surface during week 26 (the week in which peak flows occurred in the model). These results are presented in Table S.5.4. The flood protection zone for all plans except 6B and 6C is the entire 8.5 SMA (6,909 acres). For plan 6B and 6C, the flood protection zone is limited to the area east of the proposed canal. Only plan 6B would provide full flood protection. Plan 6C fails to provide flood protection to 65% of the designated protection zone. Plan 6C fails to mitigate in 3,452 acres of the designated protection zone.

Table S.5.4 Areal Extent of Area Within Flood Protection Zone And The 8.5 SMA Receiving Flood Protection

Plan	Areal Extent Flooded (acres)	Areal Extent Protected (acres)	Portion Flooded (percent)	Portion Protected (percent)
Exist	6,264	645	90.7	9.3
C-111	6,323	586	91.5	8.5
Plan 1	6,323	586	91.5	8.5
Plan 1A	6,323	586	91.5	8.5
Plan 2	6,323	586	91.5	8.5
Plan 2A	6,264	645	90.7	9.3
Plan 2B	6,205	7.04	89.8	10.2
Plan 3	6,323	586	91.5	8.5
Plan 4	6,323	6,909	91.5	100
Plan 5	6,323	6,909	91.5	100
Plan 6	540	1,452	27.1	72.9
Plan 6A	40	1,952	2	98.0
Plan 6B	0	1,992	0	100
Plan 6C	3452	1799	65.7	34.3
Plan 7	6,323	586	91.5	8.5
Plan 8	6,323	586	91.5	8.5
Plan 8A	6,172	737	89.3	10.7
Plan 9	6,205	704	89.8	10.2

Effects to Ecological Functions

Marl Forming Wetlands

Marl forming wetlands have been identified as a landscape remnant that has been lost or greatly diminished. Research indicates the following characteristics exist for marl forming wetlands (Browder 1982, Taylor 1983, Olmsted et al. 1980, Tropical BioIndustries 1990):

1) Water table recessions greater than 1.5 feet below the land surface for no more than 1 month in the driest years,

2) Hydroperiods between 1 and 6 months, and

3) Water depths greater than 2 feet for no more than 30 days.

These characteristics were applied to model output to screen for potential locations of marl forming prairie. For existing conditions, these criteria indicated marl forming wetlands on the western edge of the 8.5 SMA (Figure 28 of the Draft CAR). The presence of muhly grass noted by WRAP members confirmed these results, which are presented in Table 5. Existing modeled marl forming wetlands encompassed 1,885 acres, with 1,564 of those acres in the 8.5 SMA. Under plan 6C 75% of the marl forming wetlands would be lost.

Table S.5.5 Acres of Marl forming Wetlands

	Areal Extent of Marl forming Wetlands in:	
Parameter	NESRS + 8.5 SMA (acres)	8.5 SMA only (acres)
Existing	1,885	1,564
D13R_95ops:		
Restored Conditions	1,397	1,289
Plan 1	2,428	1,387
Plan 2B	3,675	1,204
Plan3	2,110	2,002
Plan 6B	591	483
Plan 6C	556	38
Plan 8A	1,051	943
Plan 9B	3,675	1,204

Compatibility with Future Restoration and C-111

Features Needing Rehabilitation or Removal

Model scenario D13R from the Comprehensive Everglades Restoration Plan utilizes structure S–356 for water supply to NESRS. Under the current model runs for the 8.5 SMA, S–356 is located along the L–29 alignment near S–334. Because proposed future restoration calls for filling in the L–29 canal, S–356 would have to be moved to L–31N. Relocation of this structure may have

unforeseen impacts on the northeast portion of the 8.5 SMA. Any of the alternatives where residents remain in the 8.5 SMA would be potentially affected by moving S–356. Under plan 6C residents would have the expectation of flood protection with the canal and levee in place and might experience higher water levels when S–356 is relocated.

Function Of 8.5 SMA In Historical Flow Regime And Future Restoration

The 8.5 SMA functioned as a perimeter wetland in the historical Everglades. These perimeter wetlands are the prime habitat for a diverse population of aquatic and terrestrial species, including wading birds and, especially, wood storks. Although it is a small piece of the massive Everglades system, it is an essential component of the required landscape mosaic. It provides the flow-way for water delivery to the Rocky Glades and recharge to Taylor Slough (Merritt 1996).

As restoration proceeds, there will be a tendency to build canals, levees, and other barriers to allow high water levels to be retained in marshes while at the same time allowing for agricultural and residential uses in neighboring landscapes. The perimeter areas that historically were wet in the wet season and dry during the dry season, would be in danger of being lost to a system in which canals and levees keep water levels high on the wet side and low on the dry side. However, it is these exact same perimeter zones that are needed to complete the landscape and restore ecological function. The future of a healthy and fully functional Everglades would not be met if these important peripheral wetlands were eliminated one piece at a time. For this reason, plans that allow for continued development in the 8.5 SMA, including Plan 6C are regarded as least consistent with the long-term goal of restoring Everglades ecological function. This is demonstrated by the dramatic loss of marl forming wetlands under Plan 6C.

Supplement to Chapter 6 — Wetland Functional Evaluation

Wetland Rapid Assessment Procedure

To compare relative differences (both losses and gains) in wetland function between the "existing condition" and the ten project alternatives, the Wetland Rapid Assessment Procedure (WRAP) was employed (Miller and Gunsalus 1997). The WRAP methodology has been adopted by the Corps as the most reliable and consistent approach to account for changes in wetland function for Everglades restoration projects in South Florida (letter dated August 4, 1999).

WRAP is a matrix developed to assist in the functional evaluation of wetland sites. The matrix can be used in combination with professional judgment to provide an accurate and consistent evaluation of wetland sites. The WRAP matrix establishes a numerical ranking for individual ecological and anthropogenic factors (variables) that can strongly influence wetland function. The numerical output for the variables is then used to evaluate current wetland condition. Each wetland type is scored according to its attributes and characteristics. WRAP variables include the following: (1) wildlife utilization, (2) wetland overstory/shrub canopy of desirable species, (3) wetland vegetative ground cover of desirable species, (4) adjacent upland/wetland buffer, (5) field indicators of wetland hydrology, and (6) water quality input and treatment systems. The score of each wetland habitat type (polygon) is then multiplied by the acreage of that habitat type to derive "functional units" for comparison purposes.

To adequately evaluate wetland function within the study area, wetland habitat polygons were systematically developed by overlaying 4 basic wetland habitat types (graminoid, herbaceous, shrubby, and forested) over 3 ranges of topography (<6.5 feet, 6.5 to 7.0 feet, and >7.0 feet NGVD) within the 8.5 SMA. To adequately evaluate wetlands potentially impacted by project operations, wetlands in ENP adjacent to 8.5 SMA were included (short hydroperiod wetlands, long hydroperiod wetlands, forested wetland systems, and forested exotic wetlands).

From December 1999 through February 2000, the WRAP Team conducted a series of on site field investigations, consisting of 37 survey sites representative of 17 wetland habitat types (polygons) inside and adjacent to the 8.5 SMA to establish the "existing condition" wetland functional conditions. On February 17, 18, and 22, 2000, the WRAP Team (without representatives from the SFWMD and the Miccosukkee Tribe) convened to calculate the "with-project" wetland functional projections for the nine original alternatives proposed for the project. The team met again on April 18, 2000 to consider and additional alternative, 6C. Best professional judgment in combination with hydrologic model outputs (MODBRANCH, U.S. Army Corps of Engineers), which quantified spatial

hydroperiod projections developed for construction and operational features for each alternative, were used to perform this component of the evaluation. The results of the WRAP assessment are described below.

Wetland Rapid Assessment Procedure Results

Alternative Assessment

Alternative 6C

The WRAP Team with representatives from the Corps, the Service, Miami-Dade DERM, and ENP, reconvened on April 18, 2000 at the Corps Regulatory Office in Kendall, Florida, to evaluate this alternative. Hydrologic modeling output, consistent with that generated to evaluate the other nine alternatives, was used in this analysis.

This alternative is a flood mitigation plan and although presented as a revision of Alternative 6B, appears to more closely resemble the general alignment, format and function of Alternative 2. Generally, levee and canal alignment correspond to the existing "Save Our Rivers" land acquisition boundary, which follows a parallel line, ranging from 0.25 to 0.75 miles east and south of those same features associated with Alternatives 1, 2, and 9. Predictably, ecological effects are similar to those resulting from the implementation of Alternatives 1, 2, and 9. However, drydown of wetland habitats from hydrologic edge effect is not as significant and implementation of this alternative would likely result in the restoration of an additional 1,200 acres of existing short hydroperiod wetlands when compared to Alternative 1. Functional lift of these wetlands would result primarily due to the location of the canal and levee alignment and through appropriate ecological management. Little or no hydrologic improvement from construction and operation of this plan would be realized. Functional lift of these lands should be consistent with maximum lift attainable through total acquisition of the area, including conversions of shrubby and exotic-dominated habitats to native landscapes over the project life of 50 years.

Further west of the levee and canal, long hydroperiod wetlands and forested wetlands would be impacted from shifts in species composition. Forested exotic wetlands in ENP would experience no effect from implementation of this alternative because associated features and functions would neither benefit nor hinder ongoing management practices. Wetland function in ENP would be the same for this alternative as Alternatives 1, 2, and 9, except for the loss of 125 acres of short hydroperiod graminoid wetlands in the Doctors' Ranches area of ENP which fall under and within the levee and canal alignment adjacent to Section 11 in the upper-most northeastern portion of the 8.5 SMA.

Table S.6.1 presents the With-Project WRAP results, by polygon scores, acreage and Functional Units, for Alternative 6C. The highest WRAP scores calculated were for the 8.5 SMA wetlands which would be restored after acquisition (0.85). The lowest WRAP score calculated (0.53) was for the Forested Exotic Wetlands

in ENP. WRAP scores for wet and dry season conditions were averaged to calculate a single Functional Units (FU) score by habitat type.

Table S.6.1 With-Project Condition WRAP Polygon Scores, Acreages, and Functional Units for Alternative 6C for the 8.5 Square Mile Area, Miami-Dade County, Florida

Wetland Type	Score	Acres	Functional Units
Everglades National Park			
Forested Wetland	0.82	889	729
Forested Exotic	0.53	3,209	1,701
Long Hydroperiod Graminoid	0.82	7,188	5,894
Short Hydroperiod Graminoid	0.70	2,956	2,069
Short Hydroperiod Graminoid (Doctors' Ranches)	0.00	125	0
Subtotal		12,242	10,393
8.5 SMA			
Graminoid Wetland @ > 7.0 feet (FAA Site)	0.53	300	159
Graminoid Wetland @ < 7.0 feet (SOR Lands)	0.85	800	680
Herbaceous Wetland Low to Moderate Disturbance @ < 7.0 feet	0.85	200	170
Herbaceous Wetland High Disturbance <7.0 feet	0.85	35	30
Shrubby Wetlands (converted to Herbaceous Low to Moderate Disturbance)	0.85	105	89
Forested Native Wetlands	0.85	15	14
Forested Exotic Wetlands (Converted to Herbaceous Low to moderate Disturbance)	0.85	80	65
All Other Wetlands (inside levee and canal)	0.00	1,285	0
Subtotal		2,695	1,207
Total		17,062	11,600

Comparison of Existing WRAP Condition to With-Project Condition

Comparisons are expressed in net losses or gains in wetland functional units relative to existing condition functional units. Table S.6.2 presents comparisons of wetland FU among the project alternatives and existing conditions. Figure S.6.1 graphically displays functional gains and losses for all the alternatives compared to the existing condition wetland function.

The WRAP analysis suggests construction and operation of Alternatives 1, 2, 3, 6C, and 9 would result in wetland losses when compared to the existing condition. A total loss of 2,765 FU (1,127 in ENP and 1,638 within the 8.5 SMA) is associated with Alternatives 1, 2, and 9, whereas construction and operation of

Alternative 3 would result in a loss of 1,775 FU (137 in ENP and 1,638 within the 8.5 SMA). This significant difference (990 FU) between losses associated with Alternatives 1, 2, and 9 and losses from Alternative 3 (designs that describe the same levee dimensions and footprint) is primarily attributed to the seepage canal feature, which causes a hydrologic edge effect. Alternative 3 is designed with a seepage barrier without a canal, which minimizes wetland functional loss attributed to drydown associated with seepage into the canal. Alternative 6C also demonstrates a plan featuring a levee and canal which results in losses to wetland function (1,215 FU in ENP and 590 FU in the 8.5 SMA). This design minimizes wetland losses within the 8.5 SMA by locating the canal and levee further east than described in Alternatives 1, 2, 3, and 9, thereby facilitating the restoration of approximately 1,200 acres of short hydroperiod wetlands presently within the western and northern portions of the 8.5 SMA.

A gain in wetland function should be realized by predicted hydrologic and ecological improvements from the implementation of Alternatives 4, 5, 6, 7, and 8. Alternatives 4, 5, and 7 are non-structural, whereas both Alternatives 6 and 8 involve the construction of levees. Alternative 6 also would involve the construction and operation of a seepage canal and pump station within the protected area, whereas Alternative 8 features a natural flow-way and pump station outside the protected area. Alternative 6 would improve existing wetland function by 1,606 FU (1,290 in ENP and 316 within the 8.5 SMA), whereas the implementation of Alternative 8 would result in an increase of 2,240 FU (1,290 in ENP and 950 within the 8.5 SMA).

The difference between these two structural alternatives is found in each plan's potential to restore agricultural and residential lands to natural wetlands. Both alternatives provide equal restoration benefits to existing wetlands within the 8.5 SMA as well as improvements to ENP wetlands. However, Alternative 8 would provide optimal hydrologic conditions to wetlands adjacent to the containment levee and the FAA tract by eliminating the hydrologic edge effect associated with the seepage canal; a prominent feature of Alternative 6. Seepage losses to adjacent lands (generally along the levee alignment) would preclude restoration of those lands to functional wetlands. Alternative 7 would improve existing wetland function by 1,290 functional units, all of which are derived from improvements to ENP wetlands resulting from unimpeded restorative flows. Alternatives 4 and 5 demonstrate the greatest improvements to wetland function (2,448 FU: 1,290 in ENP and 1,158 within the 8.5 SMA). Implementation of these alternatives would enable restoration of all lands that fall within the 180-day hydroperiod to optimally functioning short-hydroperiod wetlands. Implementation of either alternative would result in improvement to ENP wetlands from unimpeded restorative flows.

Table S.6.2 Summary Comparison of Wetland Functional Units for the 8.5 Square Mile Area among Project Alternatives and Existing Condition

		Alternative									
Wetland Type	Existing	1	2B	3	4	5	6B	6C	7	8A	9
Everglades National Park											
Forested Wetland	809	729	729	791	836	836	836	729	836	836	729
Forested Exotic	1,701	1,701	1,701	2,054	0	0	0	1,701	0	0	1,701
Long Hydrp Gram	6,325	5,894	5,894	6,469	6,469	6,469	6,469	5,894	6,469	6,469	5,894
Short Hydrp Gram	2,773	2,157	2,157	2,157	2,865	2,865	2,865	2,044	2,865	2,865	2,157
Herbaceous Wetland	NA	NA	NA	NA	2,728	2,728	2,728	NA	2,728	2,728	NA
Subtotal	11,608	10,481	10,481	11,471	12,898	12,898	12,898	10,393	12,898	12,898	10,481
8.5 Square Mile Area											
Graminoid Wetland < 7.0 ft	1,043	0	0	0	1,231	1,231	1,228	680	1,043	1,138	0
Graminoid Wetland > 7.0 ft	159	159	159	159	159	159	99	159	159	159	159
Herb. Wetl. low-mod. Disturb. < 7.0 ft	395	0	0	0	595	595	592	324	395	532	0
Herb. Wetl. high Distub. <7.0 ft.	46	0	0	0	191	191	180	30	46	166	0
Shrubby Wetland	73	0	0	0	0	0	0	0	73	0	0
Forested Exotic Wetl. 6.5–7.0 ft	65	0	0	0	0	0	0	0	65	0	0
Forested Exotic Wetl. >7.0 ft	3	0	0	0	0	0	0	0	3	0	0
Forested Native Wetl.	13	0	0	0	14	14	14	14	13	14	0
Restored Agricultural/ Residential	0	0	0	0	765	765	0	0	0	738	0
Subtotal	1,797	159	159	159	2,955	2,955	2,113	1,207	1,797	2,747	159
Total	13,405	10,640	10,640	11,630	15,853	15,853	15,011	11,600	14,695	15,645	10,640

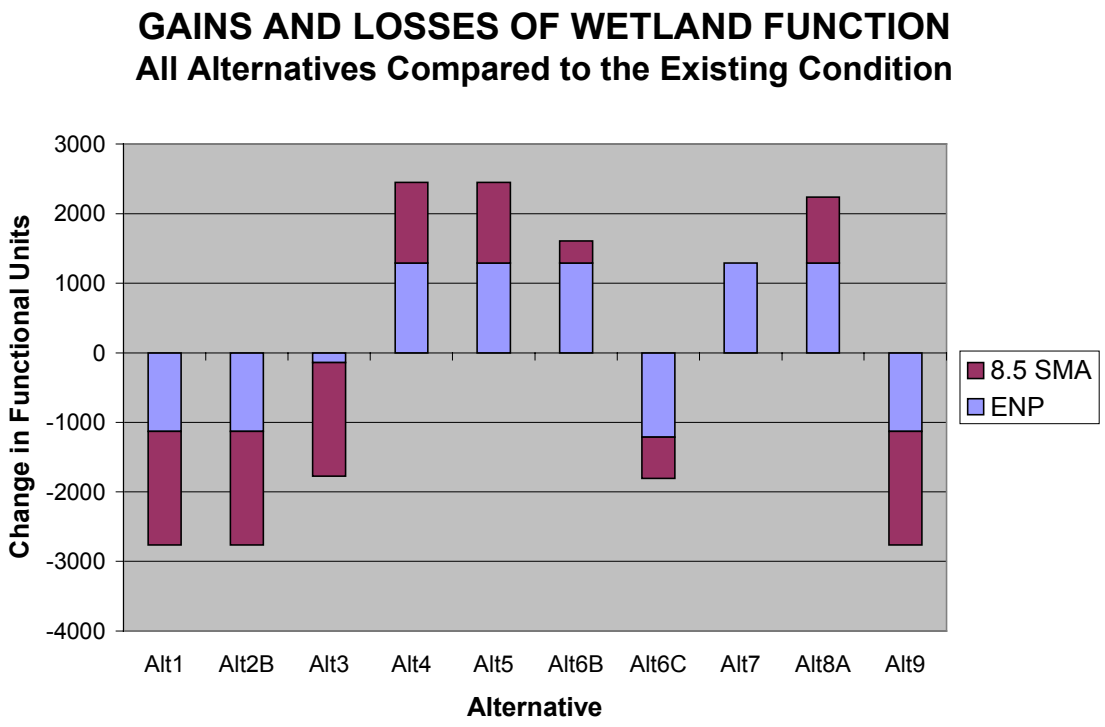


Figure S.6.1 Gains and Losses of Wetland Function

Comparison of Alternatives 2 Through 9 to Alternative 1 (No Action Plan)

The Corps has identified Alternative 1 as the No Action Alternative. This is the federally authorized project, documented in the 1992 GDM "Modified Water Deliveries to Everglades National Park", and would be the default federal action should no other alternative be selected as a result of this study. This section provides comparisons of Alternatives 2 through 9 to the No Action Alternative.

Alternative 6C — This alternative represents an improvement of 960 FU compared to the No Action Alternative. A total lift of 1,048 FU is realized within the 8.5 SMA and can be attributed to the restoration of acquired wetlands within the "Save Our Rivers" boundary. A loss of 88 functional units is attributed to the placement of levee and canal features within ENP (Doctors' Ranches), resulting in the loss of 125 acres of Short Hydroperiod Graminoid wetlands (WRAP Score = 0.70).

Compensatory Mitigation for Fish and Wildlife Losses

Wetland Mitigation for 8.5 SMA Project Alternatives

The Department views the functional losses of wetland resources associated with the 8.5 SMA as avoidable, thus any wetland impacts which are not avoided or minimized should be subject to compensatory mitigation. A detailed discussion of wetland mitigation issues is contained in the DCAR dated March 30, 2000 (pages 76 – 83).

Costs

The cost of mitigating for wetland functional losses is considered by the Corps to be a construction cost, which would be included in the overall cost of the 8.5 SMA Project (ER 1105–2–-100). More recent guidance from the Corps' headquarters (Policy Guidance Letter No. 46, dated 22 April, 1998) provides guidance on the use of mitigation banks for the Corps' civil works projects. Based on this policy, and pending the selection of a federally preferred alternative, the authority is provided to utilize mitigation banks, established pursuant to the Federal Guidelines for the Establishment, Use, and Operation of Mitigation Banks; Federal Register Volume 60, No, 228, November 28, 1995, to meet the compensatory mitigation requirements of a given civil works project.

At this time, private mitigation banks within the Mitigation Service Area of the 8.5 SMA Project charge between $20,000 and $50,000 per credit, where one credit equals one functional unit. Assuming this project would receive an average cost ($35,000 per credit), the costs of fully mitigating for wetland functional losses for the 8.5 SMA Project under each alternative are listed in Table S.6.3.

Table S.6.3 Relative Costs Associated with the Use of One or More Mitigation Banks to Compensate for Wetland Functional Losses Associated with Implementing the 8.5 SMA Project

Alternative	Cost ($ millions)
1	96.8
2B	96.8
3	62.1
4	00.0
5	00.0
6B	00.0
6C	63.2
7	00.0
8A	00.0
9	96.8

A comparison of these costs reveals that Alternatives 1, 2, and 9 incur considerable mitigation costs. Alternatives 3 and 6C also have significant mitigation costs, but represent about $30 million less in mitigation costs than Alternative 1. Implementation of either Alternative 4, 5, 6, 7, or 8 do not incur any mitigation costs, since no wetland functional losses occur with these alternatives.

(*Note: A final Compensatory Mitigation Plan will be developed pending the selection of a federally preferred alternative*)

Supplement to Chapter 7 — Federally Listed Threatened or Endangered Species

This supplement to Chapter 6 presents DOI's evaluation of potential effects of Alternative 6C on federally listed threatened or endangered occurring or potentially occurring in the study area. What follows is identical to Chapter 7 of the March 30, 2000 Draft CAR except that the potential effects of Alternative 6C have been incorporated into the text. Section 7 (ESA) issues regarding these species are addressed in Chapter 3 of the March 30, 2000 CAR. Descriptions of Alternative 6C can be found in the Supplement to Chapter 4. The evaluation addresses the snail kite and wood stork only. Evaluations of the Cape Sable seaside sparrow, as stated in the March 30, 2000 version of the Coordination Act Report were not possible due the to hydrologic modeling assumptions. Evaluation of the project regarding potential impacts to the Florida panther and eastern Indigo snake has been deferred until selection of the federally preferred alternative, at which time complete evaluations for these species will be done.

Snail Kite

Snail kites prefer long hydroperiod wetlands that experience drydown frequencies not greater than two to four years. Snail kite habitat consists of fresh-water marshes and the shallow vegetated edges of lakes where apple snails can be found. Low trees and shrubs are often interspersed with the marsh and open water. Snail kites require foraging areas that are relatively clear and open in order to visually search for apple snails. Therefore, dense growth of herbaceous or woody vegetation is not conducive to efficient foraging. The interspersed emergent vegetation enables apple snails to climb near the surface to feed, breathe, and lay eggs. Nesting almost always occurs over water. Nesting substrates include small trees and shrubs. Roosting sites are also almost always located over water (FWS 1999).

The distribution of hydroperiods (represented as an average over multiple years, rather than a given single year) for nesting kites ranges from approximately 80 to 99 percent (292 to 361 days) with a peak at about 90 percent (329 days). Foraging snail kites during non-breeding periods, however, often use habitats ranging as low as about 70 percent (256 days) hydroperiod (Bennetts and Kitchens 1997). Bennetts and Kitchens (1997) believe that maintaining deep (e.g., > 1.3 to 1.5 meters) impounded pools will result in nesting habitat degradation due to a loss of woody vegetation and degradation of foraging habitat due to a loss of wet prairie communities. Bennetts and Kitchens (1997) conclude in their study of the snail kite that the goals of restoring more of the spatial extent and hydrologic integrity (e.g., sheet flows) of South Florida wetlands will help maintain the long hydroperiod components of these wetlands important to snail kites with less of the habitat degradation than exists under the current system of water management.

With the above in mind, and within the limits of the time and model data provided, the performance measure to evaluate each alternative's potential to provide suitable snail kite habitat within the study area was developed to compare the relative performance of each alternative for this endangered species. This performance measure estimates the number of acres with water depth between 0.2 and 1.3 meters for greater than 360 days**.** The greater number of acres in NESRS that meets this performance measure is considered more beneficial for the snail kite. Evaluation of this performance measure was derived from hydrologic modeling performed by the Corps using the MODBRANCH model simulations for all alternatives with restudy (D13R) conditions under 1995 operations during a wet year (1995) and limited simulations for restudy (D13R) conditions under 1995 operations during a dry year (1989). Results for alternatives 4, 5, and 7 are the same, as they are all based on the modeling of restored conditions (see Chapter 4 for description of the alternatives). Modeling output for this performance measure is presented in Table S.7.1.

Table S.7.1 Acres Of Suitable Snail Kite Habitat in NESRS Simulated for a Wet Year (1995) And Dry Year (1989) for the 8.5 SMA Project, Miami-Dade County, Florida

	Extent of Suitable Habitat	
Alternative	Wet Year (1995) (acres)	Dry Year (1989) (acres)
Existing Condition with C–111	51,987	not available
1	54,847	22,109
2B	53,700	22,392
3	60,367	21,295
4	58,569	22,159
5	58,569	22,159
6B	57,400	22,392
6C	55,217	22,392
7[a]	58,569	22,392
8A	57,832	21,076
9	53,700	22,392

Note:

a. Alternative 7 provides an identical hydrological improvement as the restored condition. However, in the absence of post-project habitat management, some portion of foraging habitat within the 8.5 SMA would be unavailable due to the encroachment of exotic plants and continuing anthropogenic land uses.

Based on this analysis, available suitable habitat for snail kites in NESRS during a wet year is roughly twice the area (range is from 51,987 acres to 60,367 acres for all alternatives including existing conditions) as during a dry year (range is from 21,076 acres to 22,392 acres for all alternatives except existing conditions which was not run for a dry year). For the 1995 wet year, all the alternatives provide more preferred suitable habitat when compared to the existing condition with the C–111 Project. Thus, it appears that all the alternatives are compatible with hydrologic benefits provided by the restudy (D13R) conditions, although to varying degrees.

Alternative 3 (Seepage Barrier) is most compatible with the restored condition (D13R) and provides the greatest benefit (60,367 acres), followed by Alternative 4 (Total Buyout) and Alternative 5 (both at 58,569 acres). Conversely, Alternative 2B (Modified GDM Plan) and Alternative 9 provide the least benefit (both at 53,700 acres). The ranking from the greatest to lowest benefit, by alternative, is as follows: Alternative 3, Alternative 5**,** Alternatives 4 and 7, Alternative 8A, Alternative 6B, Alternative 6C, Alternative 1, and Alternatives 2B and 9. Alternatives 4, 5 and 7 would provide a hydrological improvement identical to the restored condition, however, anthropogenic dynamics could likely result in trade-offs between activities that cause losses of suitable kite habitat as well as improved habitat throughout project life. Therefore, Alternative 4 and 7 were ranked below Alternative 5.

Compared to Alternative 1 (No Action Alternative), Alternatives 3, 4, and 5 provide an additional 5,520 acres, 3,722 acres, 3,722 acres of suitable snail kite habitat, respectively.

Wood Stork

As tactile feeders, wood storks depend on the recessional fringe for foraging. It is this recessional fringe that provides a concentration of prey (fish) at an appropriate water depth. This is especially critical during the breeding season. The desirable condition for wood storks is to see a steady increase in foraging habitat during the breeding season.

According to Ogden (1996) storks feed primarily in water between 5 and 40 cm (2 to 15 inches) deep, where the water is relatively calm and uncluttered by aquatic vegetation. Almost any shallow wetland depression where fish tend to become concentrated, either through local reproduction by fishes or as a consequence of area drying, may be good feeding habitat. These sites include drying marshes, shallow roadside or agricultural ditches, narrow tidal creeks and pools, and depressions in cypress heads or swamp sloughs. However, Ogden (1996) notes, all such sites must have sufficiently long annual hydroperiods or adequately strong hydrological connections with more permanent water to produce or make available necessary densities of fishes as prey for storks.

Ogden (1996) notes that in south Florida, wood stork colonies that traditionally formed during November and December in most years now form during January, February, and March. This change in timing is correlated with a sharp decline in the number of pairs in colonies and in increased rates of nesting failures when nestlings do not fledge before the initiation of summer rains in May and June (Ogden, 1996). The changes in timing of colony formation apparently are due to the loss or degradation of substantial areas of early dry season foraging habitat in relatively higher elevation marshes (e.g., the 8.5 SMA) and in the mainland estuaries.

These once extensive peripheral short-hydroperiod wetlands provided extensive (shallow water) foraging habitat during the late wet/early dry season, the prenesting period. The disproportionate reduction (85 percent) of this specific habitat known to have occurred due to loss from development and/or degradation

(overdrainage) has been suggested as a major cause of late colony formation of wading birds at traditional colony sites located in the headwater region of downstream estuaries of the Everglades (Fleming et al. 1994).

Wood storks are highly mobile and individuals can move from one place to another on the landscape as their needs change or as the landscape itself changes. Only by having a large spatial area available are individual wood storks able to meet their demands for food, and especially the demands of offspring, over an entire yearly cycle. The lack of significant foraging area in the landscape forces the birds to postpone nesting until later in the dry season, when water levels in the long hydroperiod wetlands have declined sufficiently that feeding is possible in them (Fleming et al. 1994).

Without both the short hydroperiod wetlands to influence proper timing of nest initiation and the long hydroperiod wetlands to provide available prey to sustain adults and nestlings through the later part of the nesting period, reproduction cannot be successful (Fleming et al. 1994). Modeling studies by Fleming et al. (1994) suggest this spatial heterogeneity must be restored if wood stork populations are to recover. The authors specifically recommend restoration of at least some of the short hydroperiod wetlands that were removed on the eastern edge of the historical Everglades (e.g., the 8.5 SMA).

For this analysis wood stork habitat was defined as the number of acres with a depth of water between 0.1 and 0.25 meters. Modeled water depths were analyzed throughout NESRS and the 8.5 SMA to determine where potential stork habitat would be found and how that habitat would be changed by each alternative. These results are presented in Appendix D of the Draft CAR and the Supplement to Appendix D found in the appendix to this document.

The most striking result of this analysis is that most of the potential foraging habitat for the wood stork would occur within the 8.5 SMA. This is in complete agreement with the previous analysis indicating that the 8.5 SMA was historically the fringe area that consisted of short hydroperiod marl prairie.

Project alternatives were qualitatively ranked by interpreting the plotted curves of adequate wood stork foraging habitat found in Appendix D and the Supplement to Appendix D and determining from each graph if there was sustained habitat availability with a minimum of disruption (abrupt changes) to that availability. Rankings are as follows:

1. Alternatives 4 & 5
2. Alternative 6b
3. Alternative 8a
4. Alternative 7
5. Alternative 6C
6. Alternatives 2b & 9
7. Alternative 1
8. Alternative 3

The most ideal conditions for foraging appear to be associated with Alternatives 4 and 5 where several weeks of sustained forage availability would occur within the NESRS and 8.5 SMA. (Results for alternatives 4, 5, and 7 are the same, as they are all based on the modeling of restored conditions (see Chapter 4 of the March 30, 2000 version of the Draft CAR for description of the alternatives and Appendix D for Wood Stork Habitat under Restored Conditions).

Alternative 6b provides similar conditions; however, it would not sustain as many acres of adequate habitat over time as Alternatives 4 and 5. Alternative 8a appears to provide a similar scenario as Alternative 6b; however, pumping of the flow-way would cause some disruption between weeks 8 and 12, making this alternative less desirable. Alternative 7 would provide an identical hydrological improvement as the restored condition. However, in the absence of post-project habitat management, some portion of foraging habitat within the 8.5 SMA probably would be unavailable due to exotic encroachment and continuing anthropogenic land uses.

Alternatives 2b and 9 would provide almost no adequate habitat in the 8.5 SMA. Alternatives 2b and 9 would provide adequate habitat in NESRS throughout the year with some moderate disruption between weeks 10 and 14. Alternative 6C is similar to Alternatives 2B and 9. However, Alternative 6C would provide more suitable foraging habitat in the 8.5 SMA compared to Alternative 2B and Alternative 9. Alternative 6C also provides slightly greater total area of foraging habitat compared to 2B and 9. As in Alternatives 2B and 9, Alternative 6C also exhibits some moderate disruption. Alternative 1 would provide a similar scenario as Alternatives 2b and 9; however a considerable disruption in both the 8.5 SMA and NESRS would occur between week 43 and 47.

The most severe impact to the stork's foraging habitat would occur under Alternative 3 (slurry wall), which would tend to raise water levels on one side of the wall and lower water levels on the other side creating uniform water levels on both sides. As a result, water levels would uniformly decrease creating large and abrupt changes in the availability of foraging habitat, with peaks early in weeks 43 and 3, followed by abrupt declines as the water surface falls below the land surface. This significant and lengthy disruption appears to correspond with nesting season. Because adequate resources would be available at the onset of nesting season, wood storks would likely be well into maximum energetic investment when these resources would become unavailable within just a few short weeks. Alternative 3 appears to create an attractive nuisance.

Supplement to Chapter 8 — Preliminary Evaluation of Alternative Performance

Results from the analysis of the performance measures for each of the 8.5 SMA project objectives are detailed in Chapters 5 through 7. A brief narrative of the relative performance of each of the alternatives is provided below along with Alternative 6C.

Figures for the structural alternatives in this chapter show differences in water depth between each alternative and the predicted water levels resulting from full implementation of the MWD Project. The data used in the figures were produced by subtracting the water depth at each model cell for an alternative from the restored water depth. Positive numbers (greens) represent areas where the restored water level is higher than the alternative and negative numbers (pinks) represent areas where the alternative caused higher water levels than restored conditions.

Alternative 1

Alternative 1 performed poorly for all of the legislative requirement hydrologic performance measures. This alternative lowers water levels in both the 8.5 SMA and in NESRS (Figure S.8.1) that negate some of the benefits that could be derived from the MWD Project. It also does not provide full structural flood mitigation. In terms of the other objectives, the plan does not provide flood protection and is least compatible with future restoration. The plan performed poorly for wood storks and snail kites and had a WRAP score that reflected a loss of 2,765 functional units from existing conditions.

Alternative 2

Alternative 2 performed poorly in the legislative requirements performance measures related to restoration of NESRS, decreasing water depths in more than 35,000 acres in NESRS. The plan provided full structural mitigation. In essence, the plan mitigates for increased water levels by reducing water levels in both the 8.5 SMA and NESRS (Figure S.8.2). In terms of the other hydrologic performance measures, Alternative 2 does not provide flood protection, but does increase the spatial distribution of short-hydroperiod wetlands by draining long period hydroperiod wetlands in ENP. It does not provide flood protection to the 8.5 SMA. It is more compatible with future restoration than Alternative 1 because it would move water to the south, but is still less compatible than other alternatives. Because residents of the 8.5 SMA would be allowed to remain, this alternative would provide the perception of flood protection. However, neither adequate flood mitigation nor protection would be provided. The alternative performed poorly for wood storks and snail kites. The WRAP score reflected a loss of 2,765

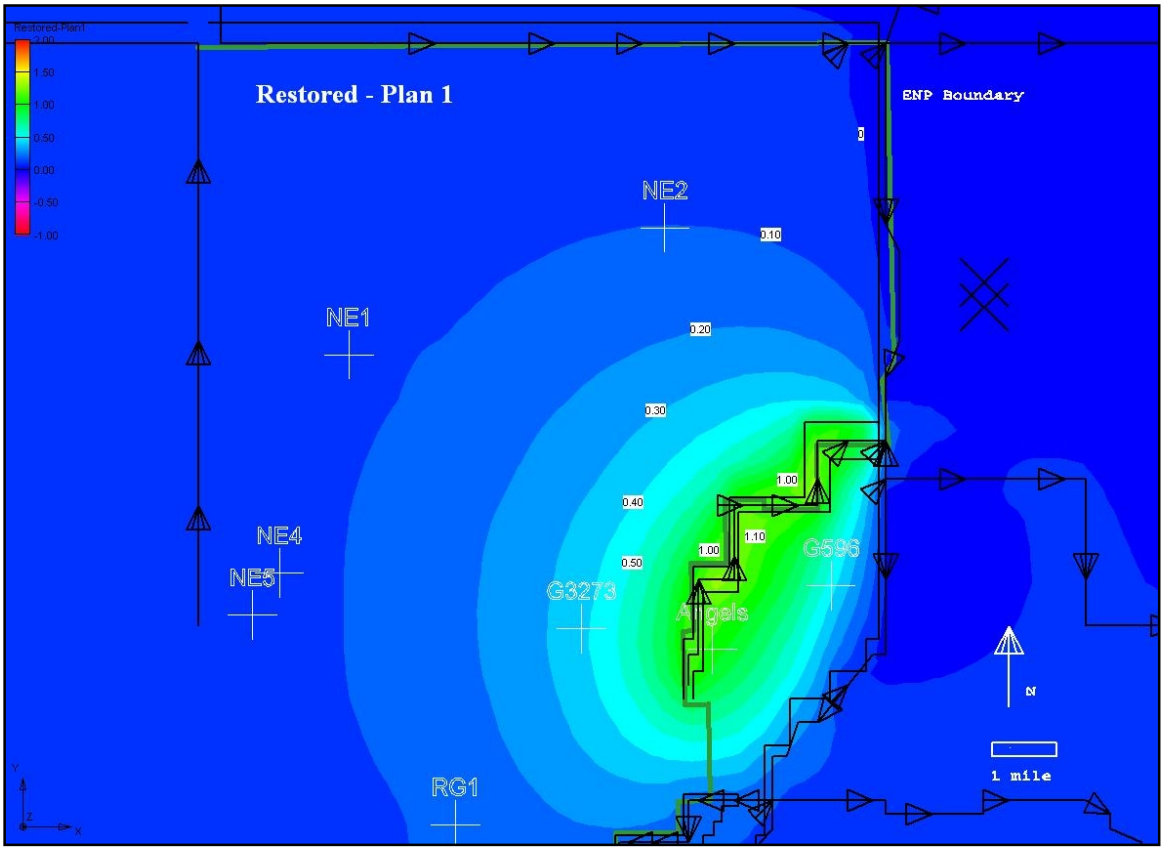


Figure S.8.1 Difference in average water depths between the restored condition following full implementation of MWD and Alternative 1 (lowered water depths in NESRS by 0.1–1.0 feet relative to restored conditions in ENP following full implementation of MWD)

functional units from existing conditions. Thus, as with Alternative 1 Alternative 2 would result in a loss of functional wetlands if implemented.

Alternative 3

Alternative 3 performed poorly in the legislative requirement hydrologic performance measures pertaining to flood mitigation. It does not provide full structural flood mitigation to more than 4,000 acres within the 8.5 SMA. Alternative 3 performed well in the re-establishment of hydropatterns in NESRS, increasing water depth over 12,000 acres in NESRS (Figure S.8.3) and performing best for snail kite habitat. For the hydrologic performance measures associated with the other project objectives, the plan ranked high in terms of providing short hydroperiod wetlands, but investigation into the wood stork performance measures demonstrated that the abrupt change from shallow to deep water at the seepage wall boundary would create unnatural drydown patterns and abrupt reductions in stork feeding habitat during the breeding season. It would not provide flood protection to the 8.5 SMA. The permanent nature of the seepage barrier, its placement in the historical flow path, and the likelihood of increased flooding due to relocation of S–356 caused the plan to perform poorly in regards to future restoration. Alternative 3 had a slightly better WRAP score

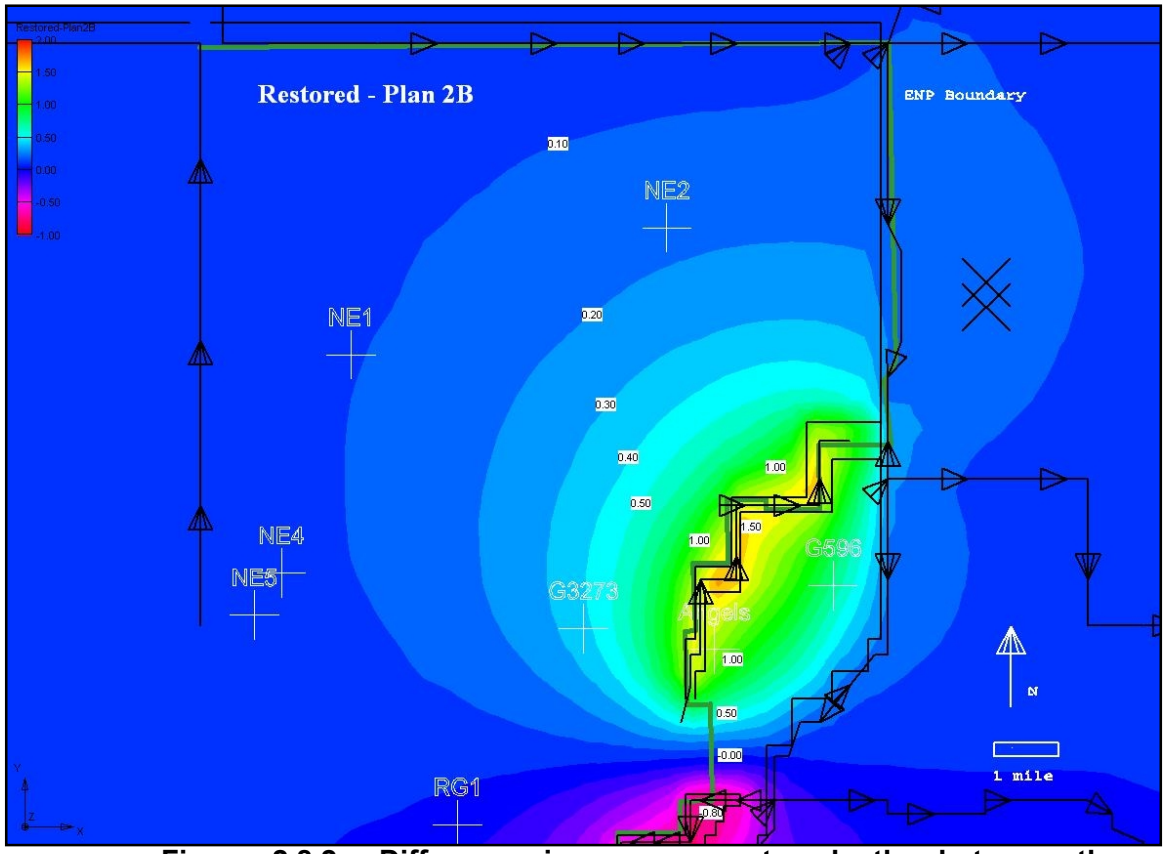


Figure 2.8.2 Difference in average water depths between the restores condition following full implementation of MWD and Alternative 2B(Alt 2B lowered water depths in NESRS by 0.1-1.5 ft and increased depths to the south by 0.8 ft)

than either Alternative 1 or 2, but its implementation would still result in a net loss of 1,175 functional units from existing conditions.

Alternative 4

Alternative 4 performed well in all of the legislative requirement hydrologic performance measures. Full flood mitigation would be achieved through buyout, flowage easements, and life estates. No reductions in hydroperiods or water levels would occur in NESRS. In terms of performance for the other objectives, the plan would be less superior in providing for short hydroperiod wetlands. Damages due to flooding would not occur due to acquisition of the area. This alternative is considered more compatible with future restoration than the structural alternatives, but would be less compatible than full buyout because the residents might experience an increase in flooding due to relocation of S–356. Performance was high for wood stork habitat and moderate for snail kite. Wrap scores for Alternative 4 were the highest of all alternatives evaluated by the procedure. Implementation of this alternative would result in a net gain of 2,248 functional units from existing conditions.

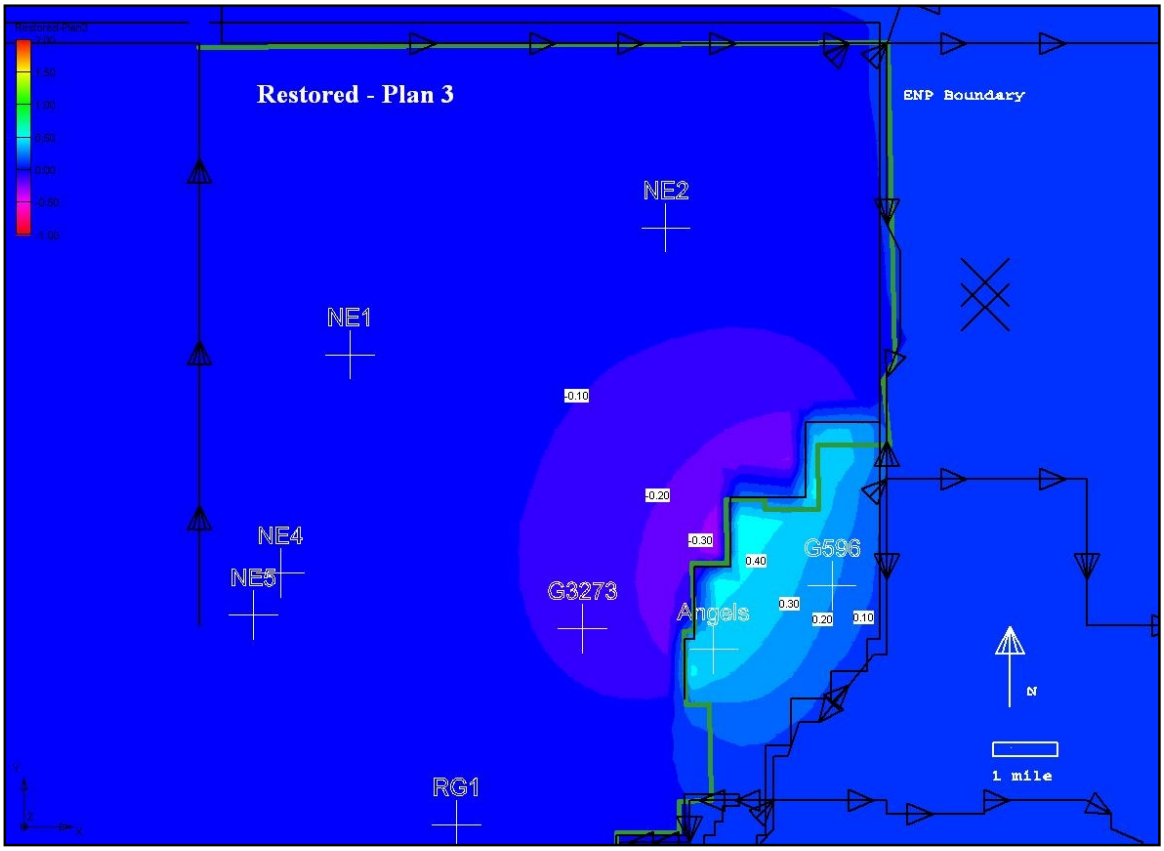


Figure S.8.3 Difference in average water depths between the restored condition following full implementation of MWD and Alternative 3 (Alternative 3 increased water depths in eastern NESRS by as much as 3 feet and decreased depths in the 8.5 SMA by as much as 0.4 feet relative to the restored condition following full implementation of MWD)

Alternative 5

Alternative 5 performed well in all of the legislative requirement hydrologic performance measures. Full flood mitigation would be achieved through buyout. No water depth or hydroperiod reductions would occur in NESRS. In terms of the performance of the other project objectives, the plan would be less superior in providing for short hydroperiod wetlands. Damages due to flooding would not occur due to acquisition of the area. It is considered more compatible with future restoration than structural options because there would be full flexibility in relocating S–356. Most importantly, restoration of the peripheral wetlands (Figure 9 of the Draft CAR) that were once found in the 8.5 SMA would allow for the full ecological function to be restored and prevent loss of critical landscape remnants. Performance was high for the snail kite and wood stork. As with Alternative 4, this alternative also had a WRAP score that reflected a net gain of 2,248 functional units from existing conditions.

Alternative 6B

Alternative 6B reduces the spatial extent of lower water levels in NESRS by moving the canal and levee alignment to the east, but it still would reduce water depth over 8,000 acres in NESRS, reducing habitat for the endangered snail kite (Figure S.8.4). Limiting the protected area to the higher elevations in the 8.5 SMA would allow attainment of full flood protection. In providing 1-in-10 year flood protection to the residents, development is expected to increase and the any future projects related to restoration would have to maintain that level of flood protection. This may require increases in pumping to accommodate the relocation of S–356. This increased pumping would cause additional reductions in water depths in NESRS and additional losses of snail kite habitat. Once this 1-in-10 year flood protection is provided, there would be no potential for restoring water levels to the historic peripheral wetlands in the 8.5 SMA (Figure 9 of the Draft CAR). Performance was moderate for snail kites. The WRAP score for Alternative 6B suggests implementation of this alternative would result in a net gain of 1,606 functional units.

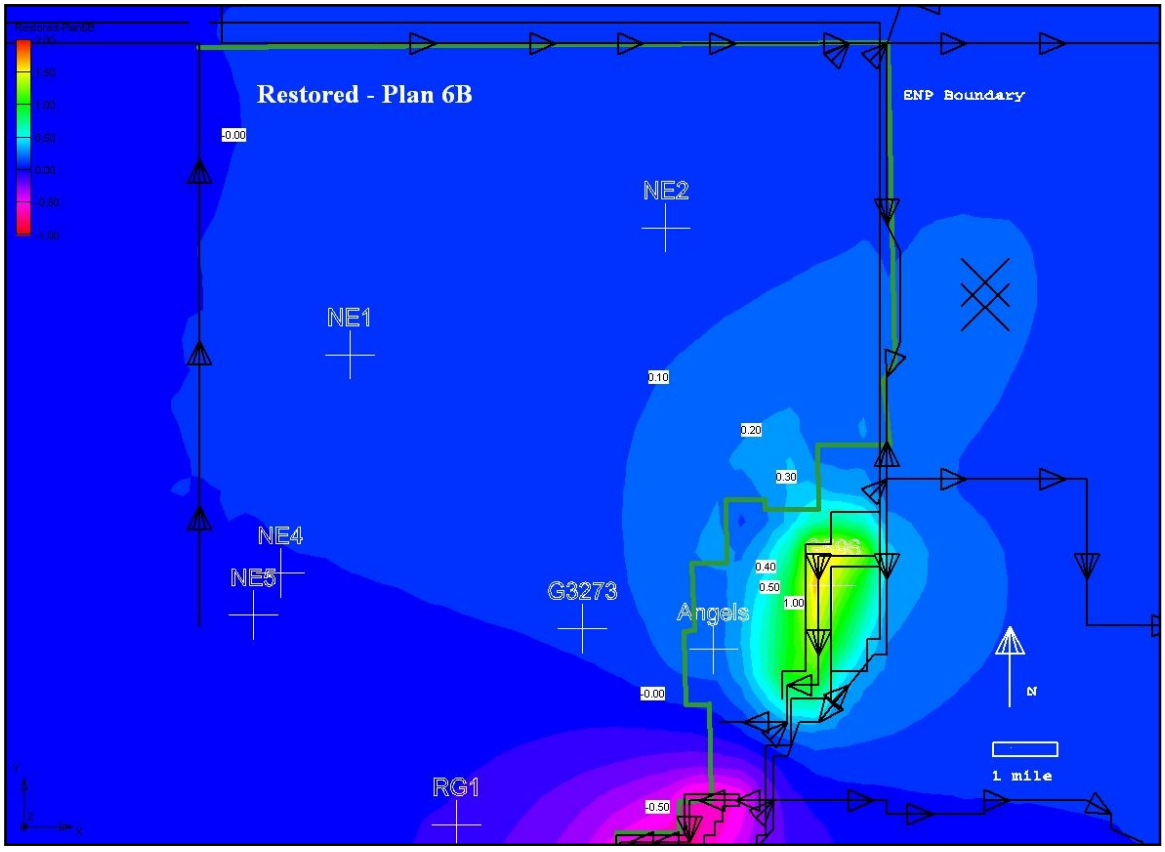


Figure S.8.4 Difference in average water depths between the restored condition following full implementation of MWD and Alternative 6B

Alternative 6C

Alternative 6C performed poorly in mandatory hydrological performance measures related to restoration of NESRS, decreasing water depths in more than 27,000 acres in NESRS (Figure S.8.5). The plan provided full flood mitigation but fails to provide flood protection for 3,452 acres, 66% of the designated flood protection zone. Alternative 6C drastically decreases the extent of marl-forming wetlands due to the placement of the canal and levee in the middle of the existing marl forming wetlands. This causes the loss of 75% of the existing marl forming wetlands in the study area (556 acres). Alternative 6C is more compatible with future restoration than Alternative 1 because it moves water south into the C-111 project, but it is still less compatible than other alternatives. This alternative would provide the perception of flood protection, however, adequate flood protection would not be provided and therefore is not viewed as a sustainable solution. The alternative performed poorly for wood storks and snail kites. The WRAP score reflected a loss of 1,215 functional units from existing conditions.

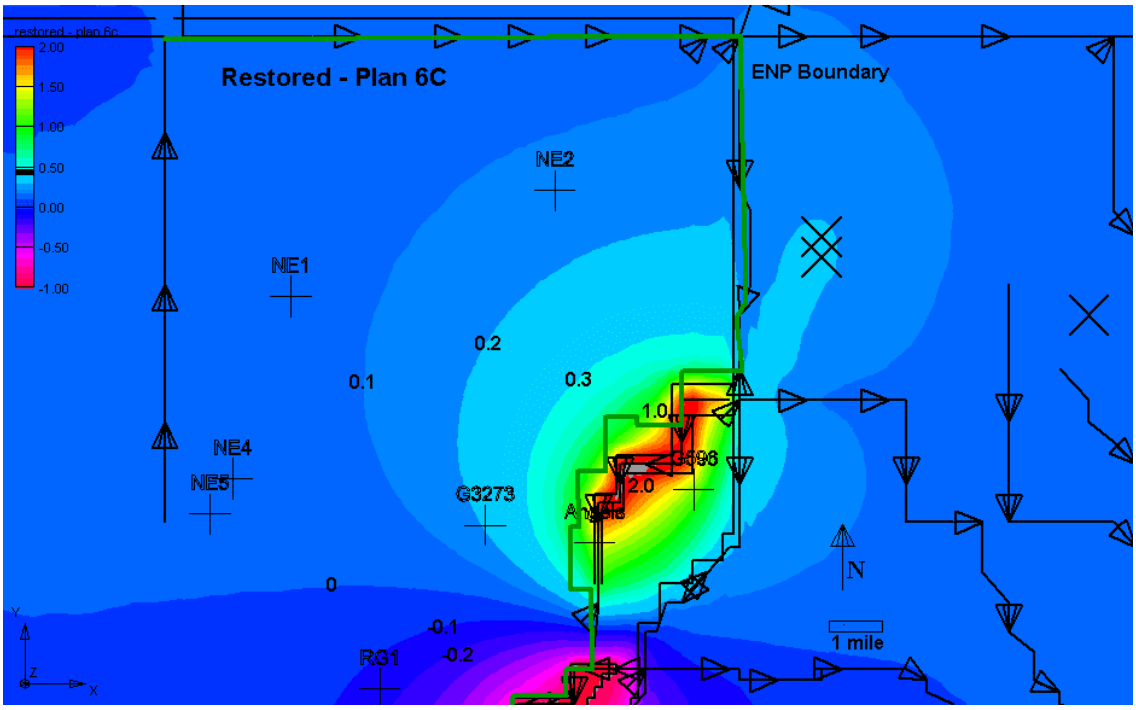


Figure S.8.5 Difference in average water depths between the restored condition following full implementation of MWD and Alternative 6C (lowered water depths in NESRS by 0.2 – 1.8 feet relative to restored conditions in ENP following full implementation of MWD)

Alternative 7

Alternative 7 performs well in that no reductions would occur in water depths or hydroperiods in NESRS. Structural flood mitigation would not occur under this alternative because residents would most likely incur more flooding as a result of raising the roads, particularly if the roads are not constructed with adequately sized culverts.

The area would not receive flood protection and would be vulnerable to increases in water levels due to relocating S–356. DOI does not consider this alternative reasonable in that raising the roads, in kind, without providing for secondary drainage is at best a temporary remedy and at worst, would cause increased flooding due to the higher retention depths of the roads. Performance was moderate for the snail kite and wood stork. The WRAP score indicates a net gain of 1,290 functional units from existing conditions would occur with implementation of this alternative. All of the improvements to wetland function for this alternative, however, would be confined to ENP. The WRAP score for Alternative 6B suggests implementation of this alternative would result in a net gain of 1,209 functional units.

Alternative 8A

Alternative 8 would not significantly impact restoration in NESRS, but it also would not provide structural flood mitigation to most of the 8.5 SMA (Figure S.8.6). It would not provide flood protection, but would provide for increases in short hydroperiod wetlands. It would be more compatible with restoration due to the minimum of structural components and the orientation of enhanced flow paths and levees along natural flow-paths. Performance was moderate for both the snail kite and wood stork. The WRAP score indicates a net gain of 2,240 functional units from existing conditions would occur with implementation of this alternative. The creation of the flow-way within the western portion of the 8.5 SMA would allow for the creation of functional post-project wetlands.

Alternative 9

Alternative 9 would perform similarly to Alternative 2.

Overall Evaluation of Performance Measures

Numerous performance measures having multiple units were evaluated in this CAR. The units range from the highly quantitative such as acres impacted to the

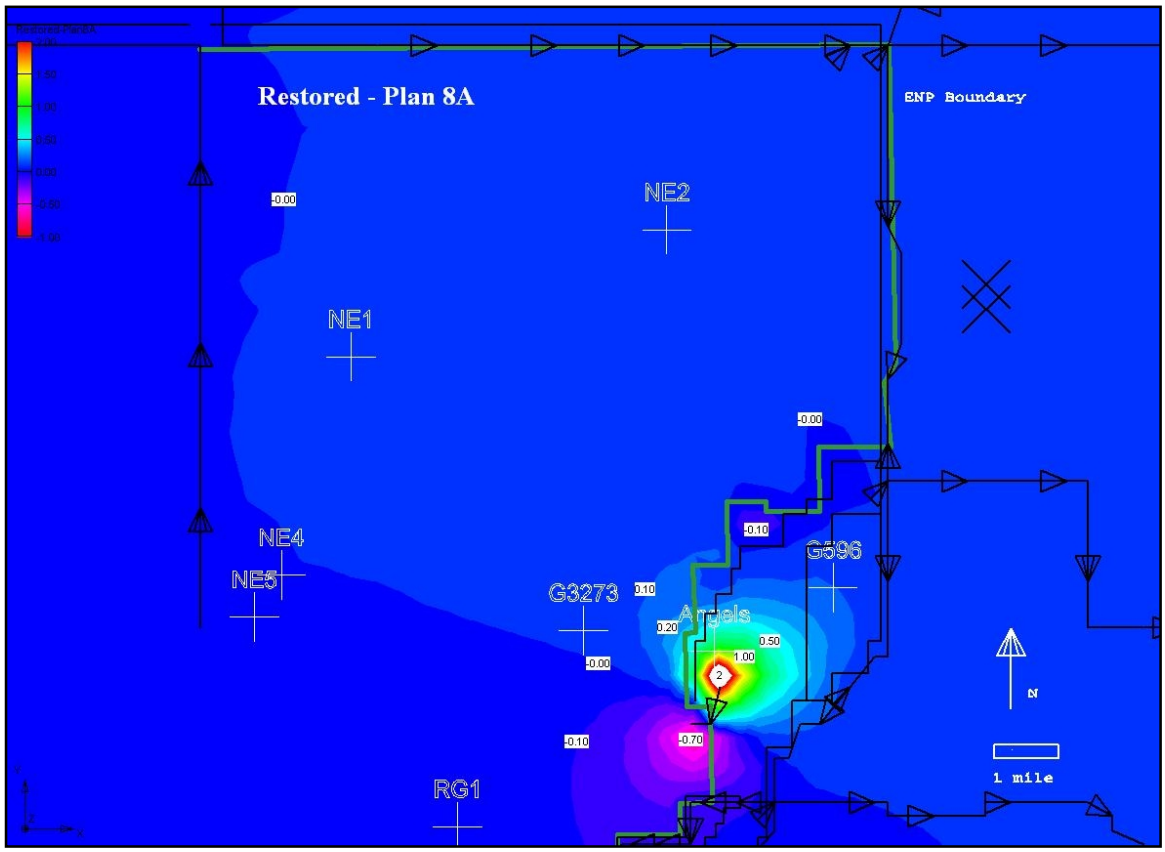


Figure S.8.6 Difference in average water depths between the restored condition following full implementation of MWD and Alternative 8A (Alternative 8 had little effect on water depth in NESRS and lowered depths near the pump by up to 2 feet)

less exact, such as a relative score based on best professional judgment. In order to present all of the performance measures for all of the objectives into a unified evaluation tool, all performance measures were combined into a series of matrices for purposes of comparing alternatives. The method and resulting evaluation tool are described below.

Results from the analysis of each of the performance measures for the set of 8.5 SMA project objectives reviewed in the CAR (Chapters 5 through 7) were incorporated into series of three spreadsheets. The first spreadsheet (Table S.8.1) contains the raw data for each of the performance measures as presented in the previous chapters. The second spreadsheet (Table S.8.2) scores the relative performance of each of the alternatives from 1 to 10 (worst to best) corresponding to the ability of each alternative in meeting the associated project objective. The scoring of alternatives was done so as to maintain the numeric range of 1 through 10 through the use of the following ranking algorithm, where *n*

$$rank = n + \frac{n + (m-1)}{(p-1)} + (m-1)$$

is the numbe $Score$ natives of a lower score, m is the number of alternatives sharing the score, and p is the total number of alternatives considered. The lowest performing alternative was assigned a score of 1 and the remaining alternatives were scored according to the expression above. Non-integer results were rounded up to the next highest integer. Scoring criteria for each performance measure depicted in Table S.8.4. The third spreadsheet (Table S.8.3) summarizes the performance for all objectives and renders a preliminary score. Table S.8.3 also incorporates a weight for each performance measure based on the relative importance DOI attached to the particular performance measure in meeting the overall purposes of the MWD Project. The weights applied were as follows:

Critical: Performances measures were classified as critical by DOI if their performance was significantly linked to the purposes of the MWD Project. These purposes include hydrological and ecological restoration of NESRS and the identification of a flood protection system for the 8.5 SMA. These performance measures were given a relative weight of 3 and were as follows:

Table S.8.1 Performance Measures Evaluation and Scoring Matrix (Raw Data)

		Alternatives										
Objectives and Performance Measures	**data units**	**Alt1**	**Alt2B**	**Alt3**	**Alt4**	**Alt5**	**Alt6B**	**Alt6C**	**Alt7**	**Alt8A**	**Alt9**	**Notes**
LEGISLATIVE REQUIREMENTS AND PERFORMANCE MEASURES												
1-Evaluate effects on hydropatterns in NESRS												
1A-NESRS increase in spatial distribution of hydroperiod	acres	0	0	82	0	0	0	0	0	0	0	Relative to restored condition
1B-NESRS decrease in spatial distribution of hydroperiod	acres	3,158	3,275	0	0	0	294	1996	0	286	3,275	Relative to restored condition
1C-NESRS increase in spatial distribution of water depth	acres	0	0	14,934	0	0	0	0	0	0	0	Relative to restored condition
1D-NESRS decrease in spatial distribution of water depth	acres	27,173	36,640	0	0	0	6,035	27,446	0	705	36,640	Relative to restored condition
2-Evakuate impacts to the landowners and residents of the 8.5 SMA resulting from implementation of the Modified Water Delivery Project												
8.5 SMA Flood Mitigation												
2A-8.5 SMA damages due to increase in hydroperiod	acres	263	0	4,257	0	0	0	0	5,976	3,934	0	Relative to exisiting condition
2B-8.5 SMA damages due to increase in surface water depth	acres	102	0	3,669	0	0	0	0	5,059	3,796	0	Relative to exisiting condition
3-Provide conditions favorable to federal and state listed endangered species survival												
Cape Sable Seaside Sparrow												
3A-Nesting opportunity changes	days	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	Requires additional COE modeling output
3B-Nesting habitat suitability changes	days	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	Requires additional COE modeling output
Snail Kite												
3C-Habitat suitability changes	acres	54,847	53,700	60,367	58,286	58,286	57,400	55,217	58,286	57,832	53,700	
Wood Stork												
3D-Habitat suitability changes	rank (1-9)	2	4	1	10	10	8	5	6	7	4	
OTHER OBJECTIVES AND PERFORMANCE MEASURES												
2- Evaluate impacts to the landowners and residents of the 8.5 SMA resulting from implementation of the Modified Water Delivery Project												
8.5 SMA Flood Protection												
2C-8.5 SMA damages by not receiving flood protection	acres	6,323	6,205	6,323	0	0	0	3,452	6,323	6,172	6,205	
Socio-economic Factors												
2D-Impacts to business	No. businesses	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	Will be provided by COE SEIS
2E-Residents relocated	No. residents	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	Will be provided by COE SEIS
2F-Lost Agricultural lands	acres	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	Will be provided by COE SEIS
2G-Unwilling Sellers	No. owners	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	Will be provided by COE SEIS
4-Analyze cost effectiveness												
4A-Project costs	1000's dollars	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	Will be provided by COE SEIS
4B-Local secondary costs	1000's dollars	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	Will be provided by COE SEIS
5-Analyze effects to ecological function												
5A(S)patial distribution of functional marl forming wetlands	Acres	2,428	3,675	2,110	0	0	591	556	0	1,051	3,675	
5B-Wetland Rapid Assessment Procedure (WRAP)	Functional units	-2,765	-2,765	-1,775	2,448	2,448	1,606	-1805	1,290	2,240	-2,765	Change from existing condition
6-Measure compatibility with CERP and C-111 Projects; maintain flood protection east of												
6A-Retrofitting of project features	Score (1-5)	1	2	1	3	5	3	2	3	3	2	(1=retrofitting high; 5=retrofitting minimal)
6B-Potential to re-establish historical flow regimes	Score (1-5)	1	1	1	4	5	1	1	3	4	1	(1=low potential; 5=high potential)
7-Avoid impacts and costs associated with time delays in implementation of alternatives												
7A-Environmental and cultural resources	Rank (1-9)	10	10	10	10	10	10	10	10	10	10	
7B-Ability to meet implementation schedule	Rank (1-9)	10	10	10	10	10	10	10	10	10	10	
7C-Construction delays	Rank (1-9)	10	10	10	10	10	10	10	10	10	10	
7D-Administrative requirements of alternatives	Rank (1-9)	10	10	10	10	10	10	10	10	10	10	

N/A= Information Not Available

Table S.8.2 Performance Measures Evaluation and Scoring Matrix (Ranking)

		Alternatives									
Objectives and Performance Measures	**rank (worst to best)**	**Alt1**	**Alt2B**	**Alt3**	**Alt4**	**Alt5**	**Alt6B**	**Alt6C**	**Alt7**	**Alt8A**	**Alt9**
LEGISLATIVE REQUIREMENTS AND PERFORMANCE MEASURES											
1-Evaluate effects on hydropatterns in NESRS											
1A-NESRS increase in spatial distribution of hydroperiod	1-10	1	1	10	1	1	1	1	1	1	1
1B-NESRS decrease in spatial distribution of hydroperiod	1-10	3	1	10	10	10	5	4	10	6	1
1C-NESRS increase in spatial distribution of water depth	1-10	1	1	10	1	1	1	1	1	1	1
1D-NESRS decrease in spatial distribution of water depth	1-10	4	1	10	10	10	5	3	10	6	1
2-Evaluate impacts to the landowners and residents of the 8.5 SMA resulting from implementation of the Modified Water Delivery Project											
8.5 SMA Flood Mitigation											
2A-8.5 SMA damages due to increase in hydroperiod	1-10	4	10	2	10	10	10	10	1	3	10
2B-8.5 SMA damages due to increase in surface water depth	1-10	4	10	3	10	10	10	10	1	2	10
3-Evaluate effects to federal and state listed endangered species survival											
Cape Sable Seaside Sparrow											
3A-Nesting opportunity changes	1-10	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
3B-Nesting habitat suitability changes	1-10	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Snail Kite											
3C-Habitat suitability changes	1-10	3	1	10	9	9	5	4	9	6	1
Wood Stork											
3D-Habitat suitability changes	1-10	2	4	1	10	10	8	5	6	7	4
OTHER OBJECTIVES AND PERFORMANCE MEASURES											
2—Evaluate impacts to the landowners and residents of the 8.5 SMA resulting from implementation of the Modified Water Delivery Project											
8.5 SMA Flood Protection											
2C-8.5 SMA damages by not receiving flood protection	1-10	1	5	1	10	10	10	7	1	6	5
Socio-economic Factors											
2D-Impacts to business	1-10	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
2E-Residents relocated	1-10	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
2F-Lost Agricultural lands	1-10	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
2G-Unwilling Sellers	1-10	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
4-Analyze cost effectiveness											
4A-Project costs	1-10	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
4B-Local secondary costs	1-10	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
5-Analyze effects to ecological function											
5A(S)patial distribution of functional marl forming wetlands	1-10	8	10	7	1	1	5	4	1	6	10
5B-Wetland Rapid Assessment Procedure (WRAP)	1-10	1	1	5	10	10	7	4	6	8	1
6-Measure compatibility with CERP and C-111 Projects; maintain flood protection east of L-31N											
6A-Retrofitting of project features	1-10	1	5	1	9	10	9	5	9	9	5
6B-Potential to re-establish historical flow regimes	1-10	1	1	1	9	10	1	1	7	9	1
7-Analyze impacts and costs associated with time delays in implementation of alternatives											
7A-Environmental and cultural resources	1-10	10	10	10	10	10	10	10	10	10	10
7B-Ability to meet implementation schedule	1-10	10	10	10	10	10	10	10	10	10	10
7C-Construction delays	1-10	10	10	10	10	10	10	10	10	10	10
7D-Administrative requirements of alternatives	1-10	10	10	10	10	10	10	10	10	10	10

N/A= Information Not Available

Table S.8.3 Performance Measures Evaluation and Scoring Matrix (Weighted Score)

			Alternatives									
Objectives and Performance Measures		**PM Weight**	**Alt1**	**Alt2B**	**Alt3**	**Alt4**	**Alt5**	**Alt6B**	**Alt6C**	**Alt7**	**Alt8A**	**Alt9**
LEGISLATIVE REQUIREMENTS AND PERFORMANCE MEASURES												
1-Evaluate effects on hydropatterns in NESRS												
1A-NESRS increase in spatial distribution of hydroperiod		Desirable	1	1	10	1	1	1	1	1	1	1
1B-NESRS decrease in spatial distribution of hydroperiod		Critical	3	1	10	10	10	5	4	10	6	1
1C-NESRS increase in spatial distribution of water depth		Desirable	1	1	10	1	1	1	1	1	1	1
1D-NESRS decrease in spatial distribution of water depth		Critical	4	1	10	10	10	5	3	10	6	1
	Objective Subtotal Score	**Mean**	**2.25**	**1**	**10**	**5.5**	**5.5**	**3**	**2.25**	**5.5**	**3.5**	**1**
2-Evaluate impacts to the landowners and residents of the 8.5 SMA resulting from implementation of the Modified Water Delivery Project												
8.5 SMA Flood Mitigation												
2A-8.5 SMA damages due to increase in hydroperiod		Critical	4	10	2	10	10	10	10	1	3	10
2B-8.5 SMA damages due to increase in surface water depth		Critical	4	10	3	10	10	10	10	1	2	10
	Objective Subtotal Score	**Mean**	**4**	**10**	**2.5**	**10**	**10**	**10**	**10**	**1**	**2.5**	**10**
3-Evaluate effects on federal and state listed endangered species survival												
Cape Sable Seaside Sparrow												
3A-Nesting opportunity changes		Critical	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
3B-Nesting habitat suitability changes		Critical	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Snail Kite												
3C-Habitat suitability changes		Desirable	3	1	10	9	9	5	4	9	6	1
Wood Stork												
3D-Habitat suitability changes		Desirable	2	4	1	10	10	8	5	6	7	4
	Objective Subtotal Score	**Mean**	**2.5**	**2.5**	**5.5**	**9.5**	**9.5**	**6.5**	**4.5**	**7.5**	**6.5**	**2.5**
OTHER OBJECTIVES AND PERFORMANCE MEASURES												
2-Evaluate impacts to the landowners and residents of the 8.5 SMA resulting from implementation of the Modified Water Delivery Project												
8.5 SMA Flood Mitigation												
2C-8.5 SMA damages by not receiving flood protection		Desirable	1	5	1	10	10	10	7	1	6	5
Socio-economic Factors												
2D-Impacts to business		Important	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
2E-Residents relocated		Important	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
2F-Lost Agricultural lands		Important	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
2G-Unwilling Sellers		Important	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
	Objective Subtotal Score	**Mean**	**1**	**5**	**1**	**10**	**10**	**10**	**7**	**1**	**6**	**5**
4-Analyze cost effectiveness												
4A-Project costs		Important	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
4B-Local secondary costs		Important	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
	Objective Subtotal Score	**Mean**	**N/A**	**N/A**	**N/A**	**N/A**	**N/A**	**N/A**	**N/A**	**N/A**	**N/A**	**N/A**
5-Analyze effects to ecological function												
5A(S)patial distribution of functional marl forming wetlands		Important	8	10	7	1	1	5	4	1	6	10
5B-Wetland Rapid Assessment Procedure (WRAP)		Critical	1	1	5	10	10	7	4	6	8	1
	Objective Subtotal Score	**Mean**	**4.5**	**5.5**	**6**	**5.5**	**5.5**	**6**	**4**	**3.5**	**7**	**5.5**
6-Measure compatibility with CERP and C-111 Projects; maintain flood protection east of L-31N												
6A-Retrofitting of project features		Important	1	5	1	9	10	9	5	9	9	5
6B-Potential to re-establish historical flow regimes		Important	1	1	1	9	10	1	1	7	9	1
	Objective Subtotal Score	**Mean**	**1**	**3**	**1**	**9**	**10**	**5**	**3**	**8**	**9**	**3**
7-Avoid impacts and costs associated with time delays in implementation of alternatives												
7A-Environmental and cultural resources		Desirable	10	10	10	10	10	10	10	10	10	10
7B-Ability to meet implementation schedule		Desirable	10	10	10	10	10	10	10	10	10	10
7C-Construction delays		Desirable	10	10	10	10	10	10	10	10	10	10
7D-Administrative requirements of alternatives		Desirable	10	10	10	10	10	10	10	10	10	10
	Objective Subtotal Score	**Mean**	**10**	**10**	**10**	**10**	**10**	**10**	**10**	**10**	**10**	**10**
Aggregate Mean Scores for all Objectives			**25.25**	**37**	**36**	**59.5**	**60.5**	**50.5**	**40.75**	**36.5**	**44.5**	**37**
Final Rank Based on Aggregate Mean Scores			**10**	**7**	**9**	**2**	**1**	**3**	**5**	**8**	**4**	**7**
			Alt1	**Alt2B**	**Alt3**	**Alt4**	**Alt5**	**Alt6B**	**Alt6C**	**Alt7**	**Alt8A**	**Alt9**

Table S.8.4 Ranking criteria for each performance measure

Legislative Requirement/ ProjectObjective	Performance Measure	Least Desirable Performance (From Rank = 1)	Most Desirable Performance (To Rank = 9)
Evaluate effects on hydropatterns in NESRS according to Section 104 of the 1989 ENP Protection and Expansion Act	1A-Increase in restored hydroperiod	Least acreage having an increase in restored hydroperiod	Most acreage having an increase in restored hydroperiod
	1B-Decrease in restored hydroperiod	Most acreage having a decrease in restored hydroperiod	Least acreage having a decrease in restored hydroperiod
	1C-Increase in restored water depth	Least acreage having an increase in restored water depth	Most acreage having an increase in restored water depth
	1D-Decrease in restored water depth	Most acreage having a decrease in restored water depth	Least acreage having a decrease in restored water depth
Evaluate impacts to the landowners and residents of the 8.5 SMA resulting from the implementation of the MWD Project according to Section 104 of the ENP Protection and Expansion Act	2A-Damages due to increases in hydroperiod	Most acreage with an increase in hydroperiod	Least acreage with an increase in hydroperiod
	2B-Damages due to increases in water depth	Most acreage with an increase in water depth	Least acreage with an increase in water depth
	2C-Acres of designated area not receiving defined level of flood protection	Most acreage not receiving desired level of flood protection	Least acreage not receiving desired level of flood protection
Evaluate effects on federal and state listed endangered species survival in accordance with the ESA of 1973	3A & 3B-Cape Sable Seaside Sparrow habitat suitability changes	N/A	N/A
	3C(S)nail Kite Habitat suitability changes	Least acreage of suitable habitat	Most acreage of suitable habitat
	3D-Wood Stork habitat suitability changes	Provides least amount of desired habitat	Provides most amount of desired habitat
Analyze effects to ecological function	4A(S)hort hydroperiod wetlands	Least acreage of short hydroperiod wetlands	Most acreage of short hydroperiod wetlands
	4B-Wetland Rapid Assessment Procedure	Least functional units	Most functional units
Measure compatibility with Comprehensive Everglades Restoration Plan and C-111 Project without adversely impacting the current level of flood protection east of L-31N	6A-Retrofitting of project features	Most retrofitting required	Least retrofitting required
	6B-Potential to re-establish historical flow regimes	Low potential to re-establish historical flow regimes	High potential to re-establish historical flow regimes
Avoid impacts and costs associated with time delays in implementation of alternatives.	7A-Environmental and cultural resources 7B-Ability to meet implementation schedule 7C-Construction Delays 7D-Administrative requirements of Alternatives	Not completed prior to other MWD Project features (Tamiami Trail)	Completed prior to other MWD Project features (Tamiami Trail)

1. Decrease in hydroperiod in NESRS
2. Decrease in water depths in NESRS
3. Damages in 8.5 SMA by increases in hydroperiod
4. Damages in 8.5 SMA by increases in surface water depths
5. Cape Sable Seaside Sparrow (CSSS) nesting opportunity changes
6. CSSS Nesting habitat suitability changes
7. Wetland Rapid Assessment Procedure or WRAP

Note: CSSS performance measures were viewed as critical because the successful implementation of the MWD Project has the potential to remove the current jeopardy opinion. Data for the evaluation of the CSSS performance measures were not available for this version of the CAR. Wetland function performance was viewed as critical to meet the ecological restoration goals of the MWD Project.

Important: Performance measures were classified as important if their performance was considered by DOI to be of significant importance for the identification of a sustainable solution for the 8.5 SMA. These performance measures were given a relative weight of 2 and were as follows:

1. Impacts to business
2. Residents relocated
3. Lost agricultural lands
4. Unwilling sellers
5. Project costs
6. Local secondary costs
7. Spatial distribution of functional short hydroperiod wetlands
8. Retrofitting of project features
9. Potential to reestablish historical flow regimes

Note: Only important performance measures 7 through 9 above were evaluated in this CAR due to the availability of information from the Corps.

Desirable: Performance Measures were classified as desirable by DOI if their performance would enhance the overall performance of the 8.5 SMA component of the MWD Project. These performance measures were given a relative weight of 1 and were as follows:

1. Increase in hydroperiod in NESRS
2. Increase in water depths in NESRS
3. Snail kite habitat suitability changes
4. Wood stork habitat suitability changes
5. Damages in 8.5 SMA by not providing flood protection

6. Environmental and cultural resources
7. Ability to meet implementation schedule
8. Construction delays
9. Administrative requirements of alternatives

Note: The snail kite and wood stork performance measures, while legislative requirements, were classified as desirable performance measures due the accessibility of appropriate habitat for these species in close proximity to the NESRS and 8.5 SMA. This is not the case for the CSSS; hence, its classification as a critical performance measure as described above.

DOI assumes that the MWD Project will not be completely functional until all components of the project have been completed. Furthermore, the Corps has assured DOI and the public that all of the components of the MWD Project will be constructed and operational by December 2005, with the Tamiami Trail modifications being the limiting component. Given this information, DOI assumes that the 8.5 SMA component will also be completed within the December 2005 time frame, regardless of the alternative chosen for implementation. DOI therefore concludes that all of the alternatives will perform equally towards meeting this objective and ranked every performance measure for the objective "Avoid impacts and costs associated with time delays in implementation of alternatives" equally.

Using the ranking criteria from Table S.8.4 and the weights as stated above, the mean rank score for each project objective was calculated as the mean of all performance measures associated with a given project objective. All mean scores for objectives were then summed across all objectives and the composite score ranked once again to identify the relative performance of each alternative with respect to each other for all performance criteria. Results of the final alternative ranking based on the relative contribution of the performance measures evaluated in the CAR are presented graphically in Figure S.8.7 (using unweighted values) and Figure S.8.8 (using weighted values).

From the results presented in Figures S.8.7 and S.8.8, the preliminary preference of alternatives for the implementation of the 8.5 SMA component of the MWD project is as follows:

Alternative 5 Performs Best for Performance Criteria Evaluated (Preferred Environmentally)

Alternative 4 Performs Well for Performance Criteria Evaluated

Alternative 6B Meets the Performance Criteria Evaluated

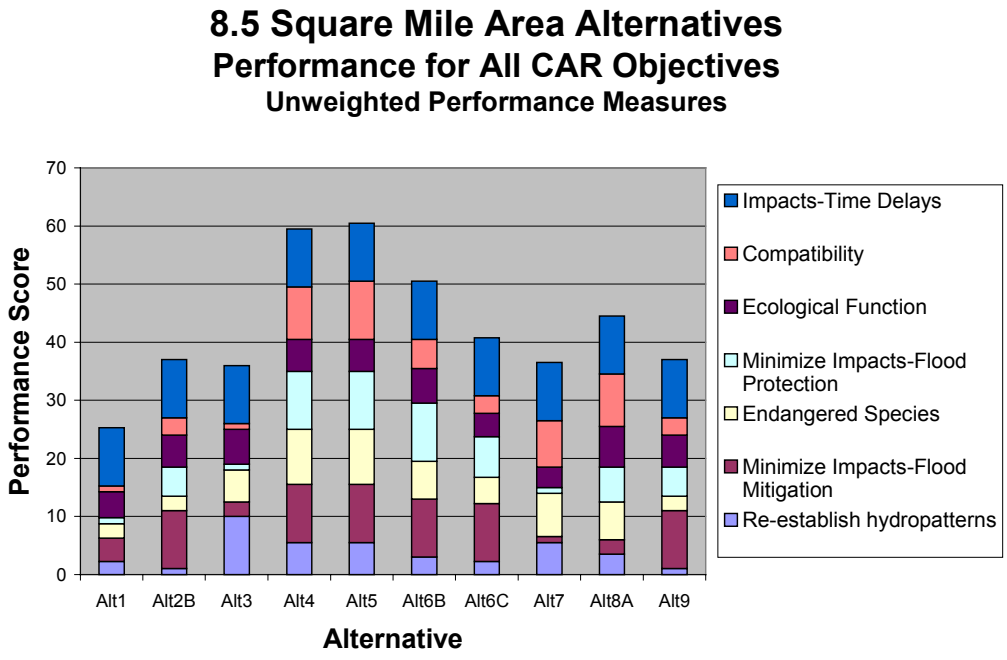


Figure S.8.7 8.5 SMA Performance Scores (Unweighted)

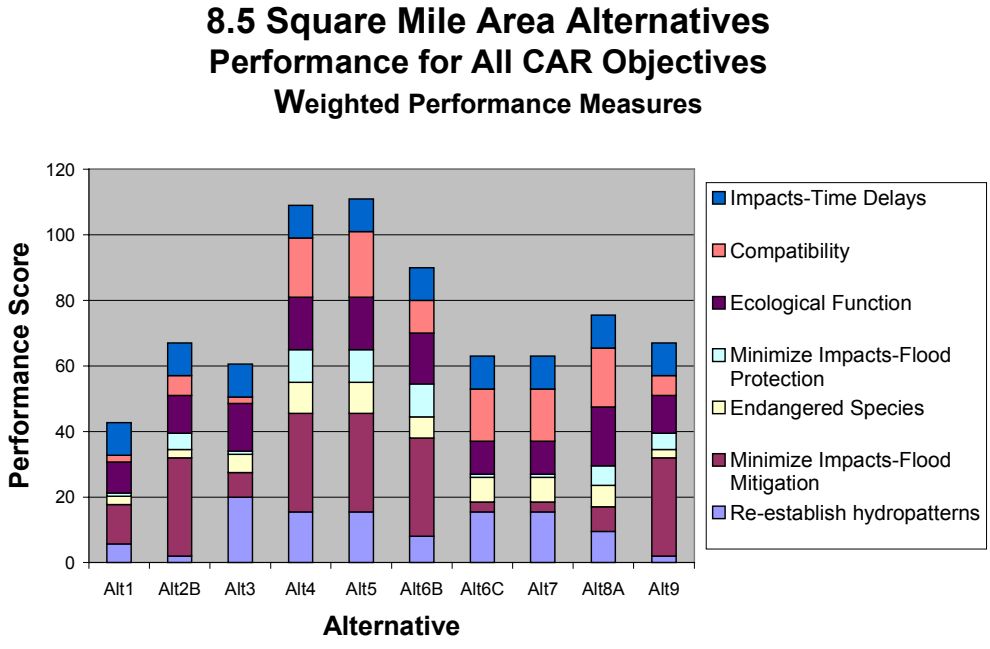


Figure S.8.8 8.5 SMA Performance Scores (Weighted)

Alternative 5 meets the legislative requirements of the project by allowing for maximum restoration of NESRS while providing flood mitigation through acquisition of the entire area. Alternative 4 also meets the legislative requirements and also accomplishes flood mitigation through purchase of land through acquisition, flowage easements and life estates. Alternative 6B, while meeting the legislative requirements, still caused a reduction in NESRS hydroperiods and water depths. However, the volume of water lost from NESRS was less than 5 percent of the total volume of NESRS (see Table S.5.2, Supplement to Chapter 5) and considered by DOI to be just within acceptable limits. For this reason, DOI would consider supporting Alternative 6B when the Corps addresses the following concerns:

1. That the decrease in water storage in restored NESRS following implementation of the final design of Alternative 6B do not exceed 5 percent of the total storage of NESRS as defined in the CAR.

2. That the final operational criteria of the C-111 Project are completely compatible with the increases volumes of water discharged to the project from the final design of Alternative 6B.

3. That adequate water quality is provided for in the final design. Appropriate measures should be taken in the final design to assure that any water of substandard quality, originating in the 8.5 SMA, would receive treatment to meet applicable state and federal water quality standards prior to discharge to ENP. These concerns for water quality extend to nutrients, pesticides, herbicides, and other compounds, such as the priority pollutants detected in water samples collected following Hurricane Irene (see Appendix E of the March 30, 2000 Draft CAR). If the Corps decides that the treatment of contaminants originating in the 8.5 SMA would be treated using features associated with the C–111 Project, the Corps should also verify that the final design of these water quality features are sufficient to meet the needs associated with the quality and loadings of water originating in the 8.5 SMA.

4. That the Corps include in the final SEIS additional hydrologic modeling investigating the feasibility of realigning the levee in Alternative 6B to allow the wetlands in the FAA's tract to be included within the buffer region.

Supplement to Chapter 9 — Preliminary Review of Supplemental Benefits and DOI Recommendations

As indicated in Chapter 1 of the March 30, 2000 Draft CAR, DOI could elect to provide additional funding for the 8.5 SMA component of the MWD Project if an alternative could demonstrate a level of performance that would result in appreciable supplemental benefits to the Everglades ecosystem, in general, and ENP, in particular.

For purposes of the CAR, DOI will only quantify the supplemental benefits associated with the alternatives when compared to the SEIS No Action Alternative or, for this evaluation, Alternative 1. The No Action Alternative, according to the Corps, would be the alternative implemented should no other alternative be selected as a result of the SEIS analysis.

For purposes of supplemental benefits, DOI only considered the critical performance measures; this suite of measures quantifies the performance of the project in meeting the MWD Project's purposes of restoration of NESRS while providing a sustainable solution for the project-induced flooding of the 8.5 SMA. These performance measures are as follows:

NESRS hydropatterns

1. Decrease in restored hydroperiod in NESRS
2. Decrease in restored water depths in NESRS

8.5 SMA Flood Mitigation

1. Damages in 8.5 SMA by increases in hydroperiod
2. Damages in 8.5 SMA by increases in surface water depths

CSSS Nesting

1. CSSS nesting opportunity changes
2. CSSS nesting habitat suitability changes

Wetland Function

1. Wetland Rapid Assessment Procedure or WRAP

As stated earlier, the CSSS nesting critical performance measures could not be assessed for this version of the CAR. These data are required under Section 7 of the ESA by DOI to evaluate impacts on the CSSS and its habitat. Therefore, the only critical performance measures reviewed by DOI for purposes of supplemental benefits were NESRS hydropatterns, 8.5 SMA flood mitigation, and wetland function.

Summary of Alternative 1 Impacts

The technical analyses detailed in Chapters 5 through 7 of the DCAR and SDCAR consistently identified Alternative 1 as the alternative exhibiting the poorest performance for most performance measures evaluated in the both versions of the CAR. While Alternative 1 does provide for flood mitigation of much of the 8.5 SMA, the analysis conducted by DOI indicates more than 200 acres of the 8.5 SMA would still not receive flood mitigation should Alternative 1 be implemented.

The major problem with Alternative 1, from the perspective of DOI, is the extensive impact this alternative has on the water levels and hydroperiods in NESRS. More than 28,000 acres of NESRS would experience water levels below the restoration targets should this alternative be implemented. Moreover, this alternative would reduce the amount of water storage in the NESRS by approximately 7,000 acre-feet (see Table S.5.2, Chapter 5), which DOI interprets as in direct conflict with the intended purposes of the MWD Project.

Comparisons of all alternatives to Alternative 1 for the critical performance measures of NERSR hydropattern restoration, 8.5 SMA flood mitigation, and wetland function are presented below.

Changes in NESRS Hydropatterns

For each of the hydropattern parameters, hydroperiod and water depth, the quantities obtained from and presented in Table S.8.1 were subtracted from the values obtained for Alternative 1. The results of the comparison are summarized in Figure S.9.1.

As seen in this figure, Alternatives 2B and 9 performed worse than Alternative 1 for changes in hydroperiod. Alternative 6C performed similar to Alternative 1 for the hydropattern performance measures. Only minor changes were noted for the water depth comparison for these two alternatives. For this reason, it is the opinion of DOI that Alternatives 2B and 9 provide no supplemental benefits for the ecosystem in general or ENP in particular.

For both hydroperiod and water depth performance measures, Alternatives 3, 4, 5, 6B, 7, and 8A showed improved performance when compared to Alternative 1, with Alternative 6B exhibiting the least amount of relative performance increase when compared to the remaining alternatives.

Changes in Flood Mitigation

Each alternative was compared to Alternative 1 for the performance measures associated with flood mitigation, hydroperiod, and water depth in the 8.5 SMA. The results of this comparison are presented in Figure S.9.21.

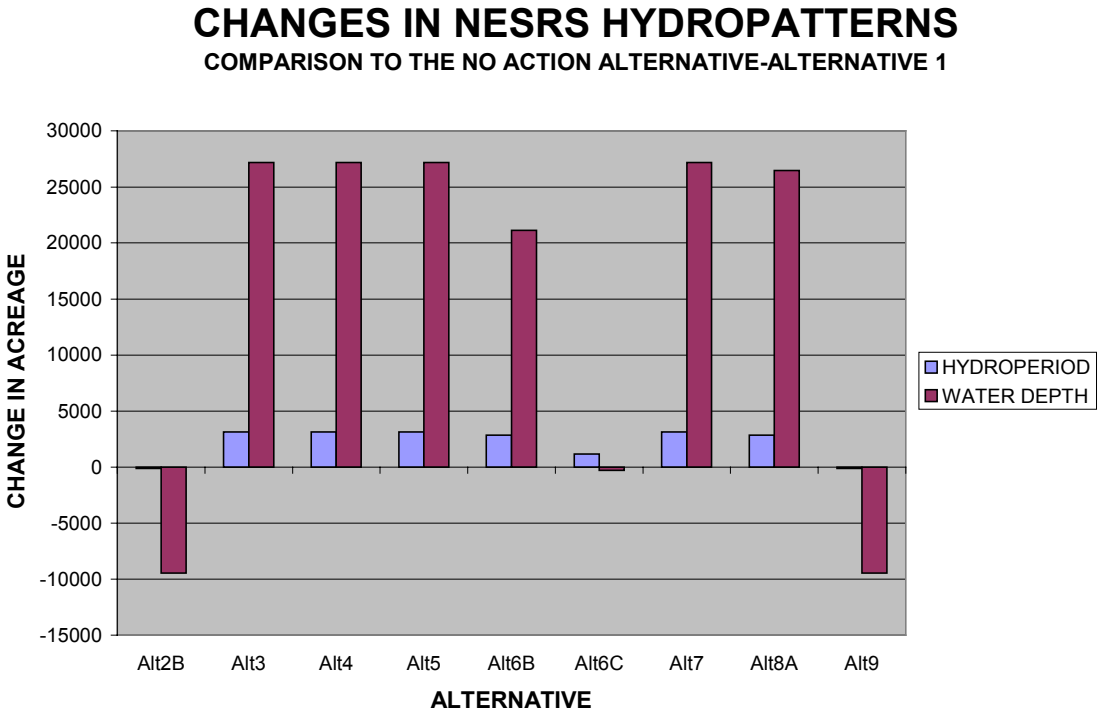


Figure S.9.1 Changes in Water Depths and Hydroperiods When all Alternatives Were Compared to the No Action Alternative (Alternative 1)

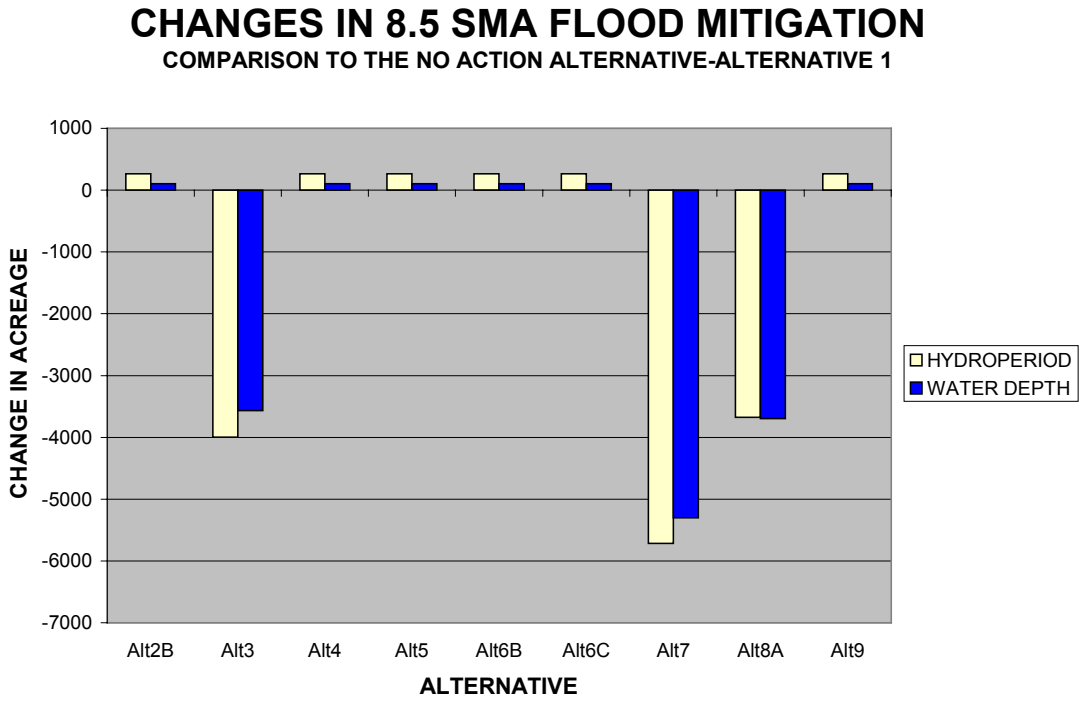


Figure S.9.2 Changes in Flood Mitigation Parameters When all Alternatives Were Compared to the No Action Alternative (Alternative 1)

In contrast to the NESRS hydropattern parameters, Alternatives 3, 7, and 8A all would have diminished performance in the area of flood mitigation when compared to Alternative 1. For these reasons, Alternatives 3, 7, and 8A also would provide no supplemental benefits for the ecosystem or ENP, in that the marked decrease in performance for flood mitigation would not meet one of the legislative requirements of the MWD Project. It should also be noted that Alternative 7 would provide no flood mitigation to the 8.5 SMA because this alternative would only raise the existing road surface elevations. It is the opinion of DOI that this would result in a worsening of conditions when compared to the existing condition.

Based on these results, DOI finds no supplemental benefits would be accrued by the ecosystem, in general, or ENP, in particular, if Alternatives 2B, 3, 6C, 7, 8A, or 9 are selected by the Corps for implementation. As depicted in figures S.9.1 and S.9.2, Alternatives 4, 5, and 6B provided incremental improvements in the performance for both NESRS hydropattern restoration as well as 8.5 SMA flood mitigation. For this reason, only Alternatives 4, 5, and 6B were considered for further evaluation of potential supplemental benefits. Each of these alternatives would involve the acquisition of significant portions of the 8.5 SMA to act as a buffer between the developed areas to the east and the restored wetlands to the west.

Changes in Wetland Function

Use of the wetland function analysis as the basis for the determination of supplemental benefits has several advantages. First, the WRAP integrates a number of potentially disparate wetland characteristics (e.g., hydrology, vegetation, and soils) into a single wetland function unit. This allows for a more direct comparison of alternatives. Second, the protocol for the WRAP analysis is based on input from a number of different agencies and organizations. This has the advantage of providing a widely accepted technique to the decision-making process. Third, the procedure has been documented in a publication used by the SFWMD, the local sponsor for the project (Miller and Gunsalus 1997).

Based on information presented in Chapter 6, wetland functional units for both ENP and the 8.5 SMA for Alternatives 4, 5, and 6B were subtracted from the wetland functional units for Alternative 1. Figure S.9.3 depicts the expected increases in wetland function for each of alternative compared to the No Action Alternative (Alternative 1). As seen in this figure, the increases in wetland function for wetlands within ENP and the 8.5 SMA are improved considerably when compared to the wetland function associated with Alternative 1.

It is the opinion of DOI that this increase in wetland function is representative of the supplemental benefits that are accrued by both the NESRS in ENP and by the wetlands within the 8.5 SMA. For all alternatives, the supplemental benefits accrued by ENP are the same, 2,417 functional units, or approximately one-half of the total benefit accrued by the combined areas of NESRS and the 8.5 SMA. The potential increase in wetland function within the 8.5 SMA ranges from 1,954 functional units for Alternative 6B to 2,796 functional units for Alternatives 4 and 5. Increases in wetland function for both areas combined indicate an increase

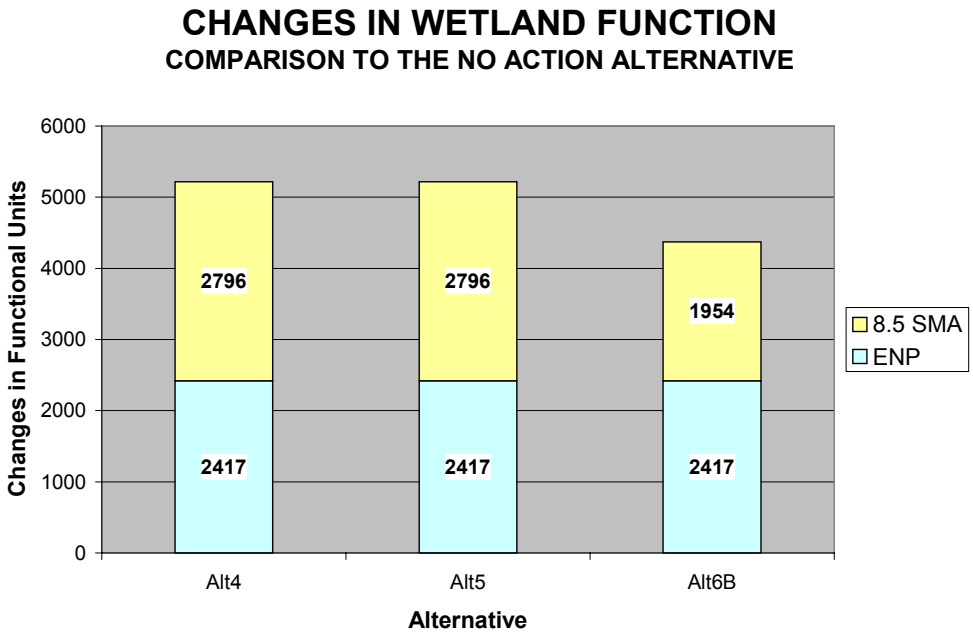


Figure S.9.3 Changes in Wetland Function within the NESRS and the 8.5 SMA when Compared to the No Action Alternative (Alternative 1)

in wetland function due to Alternative 6B to be 4,371 functional units while Alternatives 4 and 5 provide a larger lift of 5,213 functional units. The total increase in wetland function associated with Alternative 6B (4,371) represents only approximately 80 percent of the gain in wetland function over Alternative 1, when compared to either Alternative 4 or 5 (5,213). Therefore, selection of Alternative 6B as either the LPA or the federally preferred alternative would result in 20 percent fewer supplemental benefits being accrued by the Everglades ecosystem than under either Alternative 4 or 5. This level of benefit could potentially result in a reduced level of supplemental funding from the DOI sources identified in Chapter 1, should this alternative be selected over either Alternatives 4 or 5.

Recommendations

The FWS and ENP, as DOI agencies, continue to review and analyze ongoing hydrologic modeling information critical to effective planning and design for this project. As new or additional modeling becomes available, results presented herein will be updated and would potentially replace previously analyzed data used to prepare this draft report. Therefore, the FWS and ENP must emphasize that recommendations made at this time are subject to modification.

Based on analysis performed on the nine project alternatives as described and presented to DOI staff, the DOI makes the following preliminary recommendations based on the analyses contained in this version of the CAR:

1. Alternative 5 is the most environmentally preferred alternative. The DOI unequivocally and without reservation supports this alternative as the most consistent with overall goals and objectives of the MWD Project. The DOI

firmly believes that public acquisition of these flood-prone wetlands would best serve the National interest regarding protection of people and property from hazardous flooding conditions (Executive Order 11990) as well as goals and objectives regarding preservation of wetlands (Executive Order 11988). Although Alternative 4 performs well, it is the opinion of DOI that full acquisition provides more opportunity for wetland restoration and greater flexibility in post-project management. Alternative 6B meets performance criteria evaluated in this version of the CAR. DOI will consider supporting the implementation of Alternative 6B when the Corps satisfactorily addresses DOI's concerns regarding NESRS storage impacts, the C–111 Project's operations, the quality of water originating in the 8.5 SMA, C–111 Project's water quality treatment capabilities, and the wetlands in the FAA's tract, as detailed in Chapter 8.

2. DOI concludes alternatives 1, 2B, 3, 6C, 7, 8A, and 9 perform poorly for one or more legislative requirements as well as the critical DOI performance criteria evaluated in this version of the CAR. Upon interpretation of all the available data analysis presented to date, we find any structural solution, other than potentially Alternative 6B, would result in impacts on the wetlands within ENP.

3. The Corps should adopt the performance measures used by DOI in evaluating the 8.5 SMA alternatives. DOI also specifically requests that the performance measures used to assess the re-establishment of hydropatterns in NESRS be spatially based and evaluated with respect to the restored hydrologic condition. It is the opinion of DOI that the 8.5 SMA is a component of the MWD Project and; therefore, must be evaluated in accordance with the purposes and goals of the MWD Project. It must not be narrowly evaluated based solely on flood mitigation/flood protection.

4. Ecological and hydrologic monitoring should be planned and performed to adaptively assess project function throughout the project's life (50 years). Parameters measured should be consistent with the MWD Project's goals and objectives and fully coordinated with DOI's staff.

5. Upon the selection of a federally preferred alternative, the Corps should expeditiously make a determination of effects and initiate appropriate consultation under the ESA, providing thorough analysis of the alternative's potential to impact listed species and/or their habitats.

6. The Department recommends that pending the selection of a federally preferred alternative, the Corps develop a Fish and Wildlife Resource Mitigation Plan to fully off(S)et fish and wildlife resource impacts in accordance with the FWS' Mitigation Policy described in Chapter 6. The Fish and Wildlife Enhancement Features described in this report and in the Planning Aid Letter (PAL) dated January 11, 2000, provide specific design features for this purpose. This plan will be integrated into the 8.5 SMA project during the Detailed Design and Engineering Phase as a project feature. The cost of implementing this plan, including monitoring and adaptive assessment, shall be a construction cost borne by the project.

7. The Department recommends that the Corps develop a Wetland Compensatory Mitigation Plan to ensure "no net loss" of wetland function, as described in Chapter 6. This plan should be integrated into the 8.5 SMA project during the Detailed Design and Engineering Phase as a project feature. The cost of implementing this plan, including monitoring and adaptive assessment, should be a construction cost borne by the project.

Supplement to Chapter 10 — Preliminary Summary Of DOI's Position

DOI's position on the alternatives is based solely on the evaluation of performance measures as stated in this version of the CAR. The Cape Sable seaside sparrow, socio-economic, and project costs are examples of performance measures not evaluated in this version of the CAR. When this information is made available, the CAR, and potentially the DOI's position, will be modified accordingly. Additionally, DOI determined that alternatives had to meet all legislative requirements.

DOI also recognizes that the assumptions used in the CAR to define the restored MWD hydrologic condition (D13R) do not represent the conditions that will likely result when the Comprehensive Everglades Restoration Plan is implemented. DOI has long maintained that the restoration requirements of the ecosystem in general and ENP in particular exceed the conditions defined in this report.

The preliminary position of the DOI on the proposed alternatives for the 8.5 SMA component of the MWD Project and the rationale for this position is as follows:

Alternative 5 — Performs Best for Performance Criteria Evaluated (Environmentally Preferred)

Legislative Requirements

Provides for full re-establishment of hydropatterns in NESRS.

Provides for full flood mitigation of the adverse hydrological impacts associated with the implementation of the MWD Project through full acquisition.

Provides additional suitable habitats for snail kites (6,582 acres) and wood storks.

Other Objectives

Flood protection is provided through full acquisition.

Does not increase the spatial extent of short hydroperiod wetlands.

Provides for the greatest increases in wetland function in both NESRS and the 8.5 SMA.

Will not require retrofitting of future restoration project features.

Provides the maximum capability for re-establishment of historical hydrological regimes through a non-structural solution.

Supplemental Benefits

Alternative 5 provides an additional 2,417 functional units (effective wetland acreage) in NESRS.

Alternative 5 provides an additional 2,796 functional units (effective wetland acreage) in the 8.5 SMA.

Compensatory Mitigation

Will not require compensatory mitigation for wetlands and fish and wildlife resource losses.

Alternative 4 — Performs Well for Performance Criteria Evaluated

Legislative Requirements

Provides for full re-establishment of hydropatterns in NESRS.

Provides for full flood mitigation of the adverse hydrological impacts associated with the implementation of the MWD Project through acquisition, flowage easements, and life estates.

Provides additional suitable habitats for snail kites (6,582 acres) and wood storks.

Other Objectives

Flood protection is provided through acquisition, flowage easements, and life estates.

Does not increase the spatial extent of short hydroperiod wetlands.

Provides for the greatest increases in wetland function for both NESRS and the 8.5 SMA.

Will not require retrofitting of project features.

Provides the maximum capability for re-establishment of historical hydrological regimes through a non-structural solution.

Supplemental Benefits

Alternative 4 provides an additional 2,417 functional units (effective wetland acreage) in NESRS.

Alternative 4 provides an additional 2,796 functional units (effective wetland acreage) in the 8.5 SMA.

Compensatory Mitigation

Will not require compensatory mitigation for wetlands and fish and wildlife resource losses.

Alternative 6B — Meets the Performance Criteria Evaluated

Legislative Requirements

Provides for re-establishment of hydropatterns in NESRS. Adverse impacts to the restored NESRS hydroperiods and water depths are within acceptable limits established by DOI.

Provides for full flood mitigation of the adverse hydrological impacts associated with the implementation of the MWD project through flood protection to a portion of the 8.5 SMA above the 7-foot ground surface contour.

Provides additional suitable habitats for snail kites (5,413 acres) and wood storks.

Other Objectives

Provides flood protection to the designated areas of the 8.5 SMA.

Does not increase the spatial extent of short hydroperiod wetlands.

Provides for moderate increases in wetland function for both NESRS and the 8.5 SMA.

Could potentially require retrofitting of future restoration project features.

Provides for re-establishment of historical hydrological regimes.

Supplemental Benefits

Alternative 6B provides an additional 2,417 functional units (effective wetland acreage) in NESRS.

Alternative 6B provides an additional 1,954 functional units (effective wetland acreage), or approximately 30 percent less than the supplemental benefits associated with either Alternatives 4 or 5, in the 8.5 SMA.

Compensatory Mitigation

Will not require compensatory mitigation for wetlands and fish and wildlife resource losses.

Alternative 1 — Poor Performance for Criteria Evaluated

Legislative Requirements

Prevents the re-establishment of hydropatterns in NESRS due to adverse impacts on hydroperiods (3,158 acres) and water depths (27,173 acres).

Provides flood mitigation for adverse hydrological impacts of the MWD Project for all of the 8.5 SMA except for 263 acres adversely impacted through increases in hydroperiod and 102 acres adversely impacted by increased water depths.

Provides limited additional suitable habitats for snail kites (2,860 acres) and wood storks.

Other Objectives

Current levels of flooding would continue because flood protection is not provided.

Provides for a moderate increase in the spatial extent of short hydroperiod wetlands but does so at the expense of long hydroperiod wetlands.

Reduces wetland function in all of the 8.5 SMA and in significant portions of the NESRS.

Least compatible alternative with future restoration project features.

Seepage collector canal and levee prevent the re-establishment of historical hydrological regimes.

Supplemental Benefits

Alternative 1 does not meet the legislative requirements and therefore provides no supplemental benefits as defined in the CAR.

Compensatory Mitigation

Will require significant compensatory mitigation for wetlands (2,765 functional units) and fish and wildlife resource losses.

Alternative 2B — Poor Performance for Criteria Evaluated

Legislative Requirements

Prevents the re-establishment of hydropatterns in NESRS due to adverse impacts on hydroperiods (3,275 acres) and water depths (36,640 acres). Performed worse than Alternative 1 or the No Action Alternative.

Provides flood mitigation for adverse hydrological impacts of the MWD Project for all of the 8.5 SMA.

Provides limited additional suitable habitats for snail kites (1,713 acres) and wood storks.

Other Objectives

Flood protection is not provided with this alternative.

Provides for a moderate increase in the spatial extent of short hydroperiod wetlands but does so at the expense of long hydroperiod wetlands.

Reduces wetland function in all of the 8.5 SMA and in significant portions of the NESRS.

One of the least compatible alternatives with future restoration project features.

Seepage water is directed south to C–111 Project, but presence of seepage collector canal and levee prevent the complete re-establishment of historical hydrological regimes.

Supplemental Benefits

Alternative 2B does not meet the legislative requirements and therefore provides no supplemental benefits as defined in the CAR.

Compensatory Mitigation

Will require significant compensatory mitigation for wetlands (2,765 functional units) and fish and wildlife resource losses.

Alternative 3 — Poor Performance for Criteria Evaluated

Legislative Requirements

Provides for full re-establishment of hydropatterns in NESRS. Increases hydroperiods (82 acres) and water depths (14,934 acres) above the levels attained in the restored condition.

Does not provide flood mitigation for adverse hydrological impacts of the MWD Project for much of the 8.5 SMA. When compared to the existing condition, 4,257 acres would have increased hydroperiods while 3,669 acres would have increased surface water depths.

Provides additional suitable habitats for snail kites (8,380 acres) and wood storks.

Other Objectives

Does not provide flood protection to the designated areas of the 8.5 SMA..

Provides for a moderate increase in the spatial extent of short hydroperiod wetlands. All of this benefit is within the 8.5 SMA in areas designated for flood protection.

Reduces wetland function in all of the 8.5 SMA and in small portions of the NESRS.

Permanent nature of seepage barrier would potentially interfere with future restoration project features.

Seepage barrier prevents re-establishment of historical hydrological regimes.

Supplemental Benefits

Alternative 3 does not meet the legislative requirements and therefore provides no supplemental benefits as defined in the CAR.

Compensatory Mitigation

Will require significant compensatory mitigation for wetlands (1,775 functional units) and fish and wildlife resource losses.

Alternative 6C — Poor Performance for Criteria Evaluated

Legislative Requirements

Prevents the re-establishment of hydropatterns in NESRS due to adverse impacts on hydroperiods (1,996 acres) and water depths (27,446 acres).

Provides for full flood mitigation of the adverse hydrological impacts associated with the implementation of the MWD project in the 5,251 acres east of the protective levee and canal.

Provides limited additional suitable habitats for snail kites (3,230 acres) and wood storks.

Other Objectives

Does not provide flood protection to 3,452 acres of the 5,521 acres designated for flood protection.

Does not increase the spatial extent of short hydroperiod wetlands.

Reduces wetland function in parts of both the 8.5 SMA and NESRS.

One of the least compatible alternatives with future restoration project features.

Seepage water is directed south to C–111 Project, but presence of seepage collector canal and levee prevent the complete re-establishment of historical hydrological regimes.

Supplemental Benefits

Alternative 6C does not meet the legislative requirements and therefore provides no supplemental benefits as defined in the CAR.

Compensatory Mitigation

Will require significant compensatory mitigation for wetlands (1,805 functional units) and fish and wildlife resource losses.

Alternative 7 — Poor Performance for Criteria Evaluated

Legislative Requirements

Provides for full re-establishment of hydropatterns in NESRS.

Does not provide flood mitigation for adverse hydrological impacts of the MWD Project for much of the 8.5 SMA. When compared to the existing condition, 5,976 acres would have increased hydroperiods whereas 5,059 acres would have increased surface water depths or the worst performance of all alternatives examined.

Provides additional suitable habitats for snail kites (6,582 acres) and wood storks.

Other Objectives

Does not provide flood protection.

Provides no increases in the spatial extent of short hydroperiod wetlands.

Provides for no increases in wetland function for the 8.5 SMA, but provides moderate increases in wetland function within ENP.

Moderately compatible with future restoration project features; relocation of Structure S-356 in the Comprehensive Everglades Restoration Plan could increase flood frequency in the 8.5 SMA.

Elevated roads without additional culverts will prevent the re-establishment of historical hydrological regimes.

Supplemental Benefits

Alternative 7 does not meet the legislative requirements and therefore provides no supplemental benefits as defined in the CAR.

Compensatory Mitigation

Will not require compensatory mitigation for wetlands and fish and wildlife resource losses.

Alternative 8A — Poor Performance for Criteria Evaluated

Legislative Requirements

Provides for re-establishment of hydropatterns in NESRS. Reductions in storage were limited to less than 5 percent of the restoration volumes.

Does not provide flood mitigation for adverse hydrological impacts of the MWD Project for much of the 8.5 SMA. When compared to the existing condition, 3,934 acres would have increased hydroperiods while 3,796 acres would have increased surface water depths.

Provides additional suitable habitats for snail kites (5,845 acres) and wood storks.

Other Objectives

Does not provide flood protection.

Provides minimal increases in the spatial extent of short hydroperiod wetlands.

Provides for increases in wetland function for both the 8.5 SMA and ENP.

Moderately compatible with future restoration project features; relocation of Structure S–356 in the Comprehensive Everglades Restoration Plan could increase flood frequency in the 8.5 SMA.

Utilization of the natural topographic features of the western portion of the 8.5 SMA would assist in the re-establishment of historical hydrological regimes.

Supplemental Benefits

Alternative 8A does not meet the legislative requirements and therefore provides no supplemental benefits as defined in the CAR.

Compensatory Mitigation

Will not require compensatory mitigation for wetlands and fish and wildlife resource losses.

Alternative 9 — Poor Performance for Criteria Evaluated

Assumed performance identical to Alternative 2B.

Legislative Requirements

Prevents the re-establishment of hydropatterns in NESRS through adverse impacts on hydroperiods (3,275 acres) and water depths (36,640 acres).

Provides flood mitigation for adverse hydrological impacts of the MWD Project for all of the 8.5 SMA.

Provides poor habitat conditions for snail kites and wood storks.

Other Objectives

Does not provide flood protection.

Provides for a moderate increase in the spatial extent of short hydroperiod wetlands but does so at the expense of long hydroperiod wetlands.

Reduces wetland function in all of the 8.5 SMA and in significant portions of the NESRS.

One of the least compatible alternatives with future restoration project features.

Seepage water is directed south to C–111 Project but presence of seepage collector canal and levee prevent the complete re-establishment of historical hydrological regimes.

Supplemental Benefits

Alternative 9 does not meet the legislative requirements and therefore provides no supplemental benefits as defined in the CAR.

Compensatory Mitigation

Will require significant compensatory mitigation for wetlands (2,765 functional units) and fish and wildlife resource losses.

Supplement to Appendix B — Hydrologic Modeling Results for Alternative 6C

The following are the modbranch output files used to produce the results discussed in the Draft CAR and in this Supplement. Figure and Table numbers beginning with S refer specifically to this Supplement. Each of these files consists of weekly averages of the head data for each cell in the model domain so the full filename would be what is given below appended with "_weekly.hed"

The filenames are descriptive of the input file conditions. The first segment in the filename refers to the boundary conditions used, the second to the canal configuration implemented, the third to the precipitation year applied, and the fourth to the operating conditions of the canals. Files with "no10yrEvent" are 1995 precipitation year runs without the addition of the synthetic 1 in 10 year storm. Files with "356" are existing conditions runs with pumping added at S–356 in the Northeast corner of ENP so that they could be compared to the alternatives which all had pumping at S–356. Plan 2B results were reported for Plan 9B as well, since the effect was considered to be equivalent. In analyses where multiple files were compared to a standard, i.e. all the plans were compared to the restored condition, the standard filename is preceded by an *.

Figure 2 Effect of synthetic 1 in 10 year storm on water levels

D13Rbc_exist_1995_95ops
D13Rbc_exist_1995_95ops_no10yrEvent

Figure 3 Effect of synthetic 1 in 10 year storm on hydroperiods

D13Rbc_exist_1995_95ops
D13Rbc_exist_1995_95ops_no10yrEvent

Figure 4 Effect of C-111 in model simulations

D13Rbc_exist_1995_95ops
D13Rbc_C-111_1995_95ops

Figure 5 Comparison of simulated hydroperiods for 83 ops and 95 ops

D13Rbc_exist_1995_95ops
D13Rbc_exist_1995_83ops

Figures 10 – 16, S.5.1: Hydroperiods and Average Depths

D13Rbc_C-111_1995_95ops
D13Rbc_C-111_356_1995_95ops
D13Rbc_plan1_1995_95ops
D13Rbc_plan2B_1995_95ops
D13Rbc_plan3_1995_95ops
D13Rbc_plan6B_1995_95ops
D13Rbc_plan6C_1995_95ops
D13Rbc_plan8A_1995_95ops

Table S.5.1 Increases and Decreases in Hydroperiod and Average Water Depth in NESRS Relative to Restored Hydroperiod and Water Depth

* D13Rbc_C-111_356_1995_95ops
D13Rbc_plan1_1995_95ops
D13Rbc_plan1A_1995_95ops
D13Rbc_plan2_1995_95ops
D13Rbc_plan2A_1995_95ops
D13Rbc_plan2B_1995_95ops
D13Rbc_plan3_1995_95ops
D13Rbc_plan6_1995_95ops
D13Rbc_plan6A_1995_95ops
D13Rbc_plan6B_1995_95ops
D13Rbc_plan6C_1995_95ops
D13Rbc_plan8_1995_95ops
D13Rbc_plan8A_1995_95ops

Table S.5.2 Increases And Decreases In Water Volume In NESRS Relative To Restored Conditions for Wet Year (1995).

* D13Rbc_C-111_356_1995_95ops
D13Rbc_C-111_1995_95ops
D13Rbc_plan1_1995_95ops
D13Rbc_plan1A_1995_95ops
D13Rbc_plan2_1995_95ops
D13Rbc_plan2A_1995_95ops
D13Rbc_plan2B_1995_95ops
D13Rbc_plan3_1995_95ops
D13Rbc_plan6_1995_95ops
D13Rbc_plan6A_1995_95ops
D13Rbc_plan6B_1995_95ops
D13Rbc_plan6C_1995_95ops
D13Rbc_plan8_1995_95ops
D13Rbc_plan8A_1995_95ops

Table S.5.3 Increases and Decreases in Hydroperiod and Average Water Depth in 8.5 SMA Relative to Existing Hydroperiod and Water Depth

* D13Rbc_C-111_1995_95ops
D13Rbc_C-111_356_1995_95ops (used to produce data for Plans 4, 5, 7)
D13Rbc_plan1_1995_95ops
D13Rbc_plan1A_1995_95ops
D13Rbc_plan2_1995_95ops
D13Rbc_plan2A_1995_95ops
D13Rbc_plan2B_1995_95ops
D13Rbc_plan3_1995_95ops

D13Rbc_plan6_1995_95ops
D13Rbc_plan6A_1995_95ops
D13Rbc_plan6B_1995_95ops
D13Rbc_plan6C_1995_95ops
D13Rbc_plan8_1995_95ops
D13Rbc_plan8A_1995_95ops

Figure 17 Existing short hydroperiod wetlands from modeled performance measure

Filtered average of:
Base95bc_C-111_1989_95ops
Base95bc_C-111_1995_95ops

Table S.5.4 Areal Extent of Area Within Flood Protection Zone And The 8.5 SMA Receiving Flood Protection

D13Rbc_exist_1995_95ops
D13Rbc_C-111_1995_95ops
D13Rbc_plan1_1995_95ops
D13Rbc_plan1A_1995_95ops
D13Rbc_plan1B_1995_95ops
D13Rbc_plan2_1995_95ops
D13Rbc_plan2A_1995_95ops
D13Rbc_plan2B_1995_95ops
D13Rbc_plan3_1995_95ops
D13Rbc_plan6_1995_95ops
D13Rbc_plan6A_1995_95ops
D13Rbc_plan6B_1995_95ops
D13Rbc_plan6C_1995_95ops
D13Rbc_plan8_1995_95ops
D13Rbc_plan8A_1995_95ops

Table S.5.5 Acres of Short Hydroperiod Wetlands

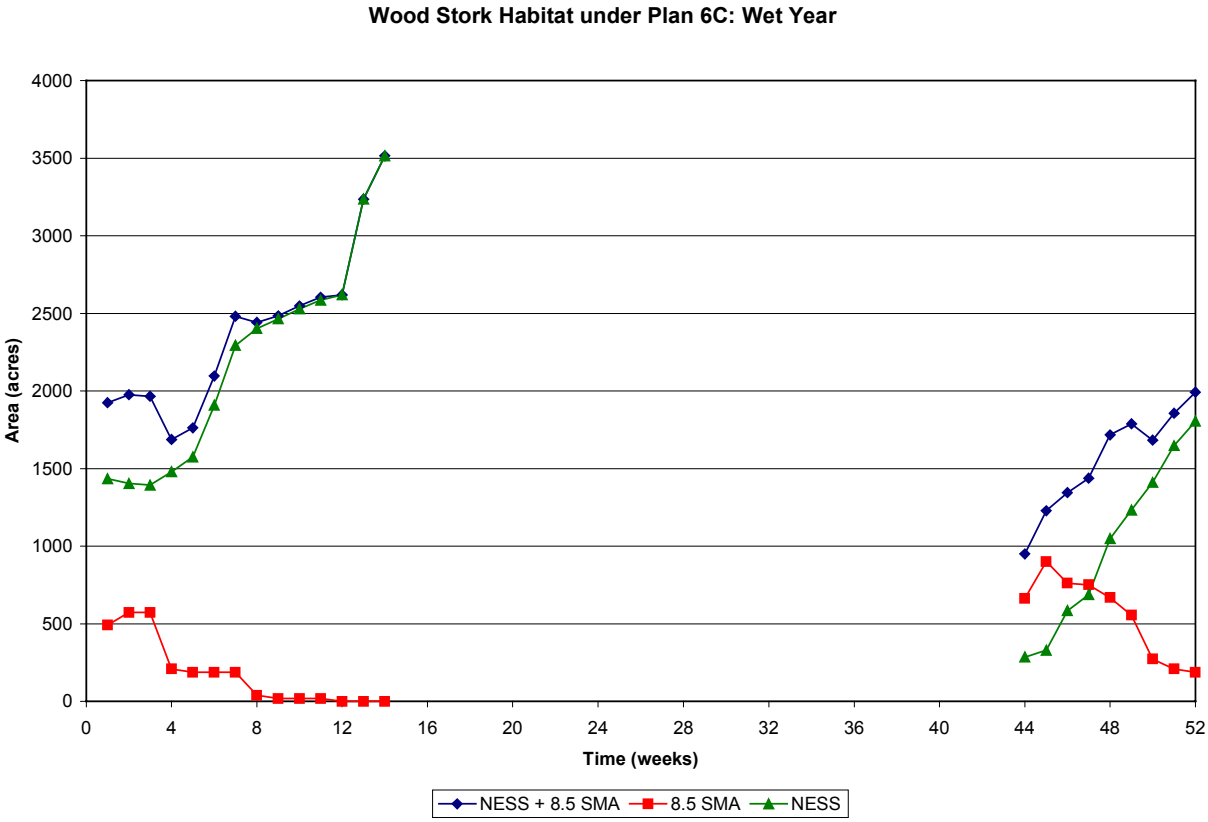
Filtered average of each of the following pairs:
Base95bc_C-111_1989_95ops
Base95bc_C-111_1995_95ops
D13Rbc_plan1_1989_95ops
D13Rbc_plan1_1995_95ops
D13Rbc_plan2B_1989_95ops
D13Rbc_plan2B_1995_95ops
D13Rbc_plan3_1989_95ops
D13Rbc_plan3_1995_95ops
D13Rbc_plan6B_1989_95ops

D13Rbc_plan6B_1995_95ops
D13Rbc_plan6C_1989_95ops
D13Rbc_plan6C_1995_95ops
D13Rbc_plan8A_1989_95ops
D13Rbc_plan8A_1995_95ops

Figures S.8.1-6 Water Depth Difference Maps (Restored – Plan)

D13Rbc_plan1_1995_95ops
D13Rbc_plan2B_1995_95ops
D13Rbc_plan3_1995_95ops
D13Rbc_plan6B_1995_95ops
D13Rbc_plan6C_1995_95ops
D13Rbc_plan8A_1995_95ops

Supplement to Appendix D — Wood Stork Analysis Results: Alternative 6C


Wood Stork Habitat under Plan 6C: Wet Year
Area (acres)
4000
3500
3000
2500
2000
1500
1000
500
0
0
4
8
12
16
20
24
28
32
36
40
44
48
52
Time (weeks)
NESS + 8.5 SMA
8.5 SMA
NESS